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URBAN AGRICULTURE VALUE CHAIN ANALYSIS

CLIENT:	KAMPALA CAPITAL CITY AUTHORITY (KCCA)
PROJECT:	CONSULTANCY SERVICES FOR URBAN AGRICULTURE VALUE CHAIN MAPPING AND ANALYSIS

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EXECUTIVE SUMMARY

Urban Agriculture is a very relevant practice in the contexts of food security, increasing income-generating activities and creating a greener economy. KCCA contracted Geo Gecko to carry out a Value Chain Analysis and Mapping focusing on mushrooms and leafy vegetables within Kampala city. This report discusses the survey results and should be read in conjunction with the web portal which will detail the results further and visualise them. The overall aim is to equip KCCA with the information needed to help policy and decision-making related to the stimulation of urban agriculture.

The study had a multi-dimensional data-gathering approach using satellite imagery, census data and qualitative in-depth survey results to create a picture of urban agriculture and related activities in Kampala. The satellite imagery was used to show the green space in the city and how much this has changed (generally reduced) over time. Census data was subsequently used to create a classification of Kampala in four similar areas based on socio-economic indicators. This classification informed where to carry out the survey and to what areas the results can reasonably be extrapolated. The survey consisted of interviews and Focus Group Discussions with urban farmers in selected parishes and key informants across the city that were able to sketch the environment around them.

The picture that emerged is that urban agriculture is mostly engaged in by females. Particularly for mushrooms, mostly men were engaged in the production due to the income potential of the enterprise. These are supplied to supermarkets and hotels and have the potential to be profitably scaled up significantly. There was an observed importation of other mushroom varieties that are not locally grown. For leafy vegetables, current activities focus mainly on supplementing the household diet and providing for neighbours. Nevertheless, also in this area there is significant opportunity to profitably scale up as leafy vegetables are being brought into the city from neighbouring districts. In addition, there is a particular opportunity to grow exotic vegetables for niche markets, especially of foreign communities within Kampala.

Major limitations faced by urban mushroom and vegetable farmers are lack of good quality inputs and lack of information on good farming practices. The authors of this report recommend an increasing capacity of extension services of KCCA and research institutions, so farmers are provided with the required quality inputs and knowledge to reach the full production potential. The KCCA Agriculture Resource Center in Kyanja can play a significant role in this regard.

Interestingly, the amount of green space available appears to not be a determining factor in the possibilities to scale up urban agriculture in Kampala. Mushroom farming is done inside (temporary) structures and leafy vegetables are mostly grown in relatively small areas. The amount of green space available would therefore only come into play for larger commercial vegetable enterprises.

The study provides KCCA with the tools and questionnaires to replicate and/or expand the study in future.

ACRONYMS

CDD:	Community Driven Development
CSO:	Civil Society Organization
EU:	European Union
FAO:	Food and Agricultural Organization
FGD:	Focus Group Discussion
GIS:	Geographical Information Systems
IPM:	Integrated Pest Management
KCCA:	Kampala Capital City Authority
MAAIF:	Ministry of Agriculture, Animal Industries & Fisheries
MUSFTNB:	Makerere University School of Food Technology, Nutrition and Bio-engineering
NARL:	National Agricultural Research Laboratories
NGO:	Non-Governmental Organization
SACCOs:	Savings and Credit Cooperatives
SWOT:	Strengths, Weaknesses, Opportunities and Threats
UBOS:	Uganda Bureau of Statistics
UIRI:	Uganda Industrial Research Institute
UPA:	Urban and Peri-urban Agriculture
VC:	Value Chain
VCA:	Value Chain Analysis

DEFINITION OF TERMS

The overview below explains terms regularly employed for the Value Chain Analysis and Mapping exercise.

STAKEHOLDERS

The target stakeholders operationally refer to those individuals and groups that are direct participants in the value chain, i.e. those that take ownership of the product as it moves along the Value Chain and those that provide services to facilitate and support the Value Chain without taking ownership of the product.

URBAN AGRICULTURE

Urban Agriculture (UA) can simply be defined as the growing of plants and the raising of animals for food, within and around cities, and is often considered an environmentally friendly activity.

The Food and Agricultural Organization of the United Nations (FAO), defines Urban Agriculture as "Agricultural practices within and around cities which compete for resources (land, water, energy, labor), that could also serve other purposes to satisfy the requirements of the urban population.

VALUE CHAIN MAPPING

Value Chain Mapping is a process that identifies the main activities associated with a given commodity or a product line. It does not necessarily represent data in a geographical way; it rather presents processes and flows from for example farmer to consumer. The term denotes a process comprising of several related steps, where each step, adds a value to the product or helps it to continue to its next step. It gives a visual representation and understanding of processes and value added to a given product or work flow.

MAPPING

The term mapping can be interpreted differently depending on the intended purpose of the exercise. Mapping in general can be understood as a graphical representation of a procedure, process, structure or system that depicts arrangement of and relationships among its different components. It may also be understood to be geographical mapping (see next section). For this study, mapping is operationally defined in two contexts.

GEOGRAPHICAL MAPPING

Geographical mapping is the creation of maps and visualizations of geographically represented data. Mapping is closely related to cartography, which is the science of communicating spatial reality in an effective and informative way. It is furthermore related to the term Geographical Information Systems (GIS), which is a system designed to capture, store, manipulate, analyze, manage and present spatial or geographical data.

MUSHROOM GARDEN

This is operationally defined as a piece of sterilized substrate packed in a container and inoculated with mushroom spawn. This varies in shape and weight depending on producers.

1. INTRODUCTION

The rapid growth of cities in the developing world is placing enormous demands on urban food supply systems. Food production in and around cities is therefore an integral part of the urban fabric in much of the developing world. In these regions, urban and peri-urban agriculture (UPA) plays an important role in helping to provide diverse urban diets and environmental services. As such, there is growing interest in UPA as a strategic component of urban resilience and climate change adaptation planning[1]. Since the current scale of UPA is difficult to assess, the limited evidence which is often qualitative, suggests that UPA is currently an important reality for many households particularly in developing countries[2]. A widely cited 1996 United Nations Development Programme (UNDP) survey, estimated that about 800 million people (i.e. 15% of the world population at that time), were involved in UPA[3]. Studies have quantified the potential contribution of UPA to food production and consumption for a few cities generally in developing countries[4], but no such assessment has been performed at the global scale.

Micro-gardening and urban farming initiatives that residents in Africa's growing cities are adopting are helping in addressing increased pressure on Africa's food security as urban populations continue to rise. They provide essential food for urban families with access to small plots of land and often generate additional income. New farming technologies requiring less soil, space and water, such as vertical farming and hydroponics (growing plants without soil using mineral nutrient solutions in a water solvent), are offering added opportunities for growing horticultural crops and mushrooms in urban environments. In Johannesburg for example, hydroponic rooftop gardens are aiding food security for vulnerable populations as well as promoting entrepreneurship.

KCCA received funding from the EU to improve the resilience of Kampala City with regard to climate change. Part of this program focuses on promoting the green and circular economy, UPA and sources of job creation, innovation and investment. As part of this, a value chain mapping and analysis was required, to better understand the range of activities involved in UPA. KCCA requested a focus on leafy vegetables and mushrooms as these are seen as areas for growth. This report describes the Urban Agriculture Value Chain Analysis and Mapping exercise carried out by Geo Gecko on this topic. It comes accompanied by a web portal giving visual and geographical insight into the data gathered and a survey tool that can be used to replicate or expand the study in future. The data included satellite imagery, population and building type data and a survey that was qualitative and in depth (rather than quantitative and statistically representative) as is common in a Value

[1] Ellie Sabiiti (2014): Building urban Resilience: Assessing urban & peri-urban agriculture in Kampala.
[2] FAO 2010: Fighting poverty and Hunger: Economic and social perspectives – Policy brief No. 10 (Rome: Economic and social development Department of the Food and Agriculture Organisation of the United Nations.
[3] UNDP 1996: Urban Agriculture, Food, Jobs and Sustainable Cities. *Publication series for Habitat II*.(New York: United Nations Development Programme)
[4] Grewal S.S. & Grewal Ps2012: Can cities become self-reliant in food? *Cities* **29** 1-11

Chain Analysis. This approach resulted in various insights on the approaches that can be taken to increase UPA in Kampala and the areas that correspond best with these different approaches.

1.1 BACKGROUND TO THE STUDY

UPA systems in Kampala play an important role in providing access to nutrient-dense foods—vegetables, meat, eggs and dairy products. Most of the UPA producers in and around Kampala are smallholders who do not sell through formal market channels as they cannot guarantee supply in the right quantities, at the right time. Secondly, farmers do not incur any additional expenses when they sell to informal buyers who they meet around their living quarters. This situation largely applies to the farming of leafy vegetables. The exception to this is mushroom production: mushrooms are majorly sold through the formal market, particularly to supermarkets.

Mushroom cultivation was introduced in Kampala in mid the 1990s. Grown mushroom species include the Oyster, Shiitake, Button and Gernoderma. The study however, purposely focuses on Oyster mushrooms as this comprised a large farmer group. The Government of Uganda and some partners have been implementing activities to support mushroom cultivation, and the industry is growing slowly but steadily, with an annual production rising from 100–200 to 400–600 metric tons over the past decade [5]. However, mushroom growing generally still remains a relatively small-scale activity compared to other agriculture activities like poultry.

1.2 PURPOSE OF THE VCA STUDY

The Value Chain Analysis (VCA) is increasingly being used in decision-making processes, to enable producers and other actors to optimize their roles and benefit from a particular value chain. In addition, the VCA helps acquire an understanding of often complex systems, with multiple interdependent needs. It indicates where the main bottlenecks are, which part of the chain holds up progress, and who can be expected to address them. In addition, the project is replicable as it equips KCCA with the tools and methodology to replicate the mapping and survey in future. This allows for further areas to be surveyed and/or for differences to be identified over time and geographies.

The purpose of this study therefore was to:

- Create a classification of Kampala based on socio-economic indicators that inform what areas of Kampala are similar for the purpose of data collection and amount of green space available giving insight into the potential for urban farming;

[5] Growing Uganda's Mushroom Farming: A Policy brief April 2017.

- Create understanding of how the mushroom and leafy vegetable enterprises value chains are comprised and how the different actors in these two value chains operate within the area of Kampala;
- Recommend opportunities on how the mushroom and leafy vegetable value chains can be improved;
- Recommend opportunities on how urban agriculture can be increased and how to relate input suppliers and processors to this;
- Equip KCCA with tools and methodologies to continuously conduct the value chain mapping and analysis.

The deliverables of the study are:

- Amount of green space available for increase urban farming;
- Correlation between relevant socio-economic indicators and how they apply across parishes in Kampala and the relation to urban farmer survey results;
- Main actors involved in the mushroom and leafy vegetable value chains mapped and identified and core processes mapped;
- Flows of products as well as knowledge flows and gaps mapped;
- Trends analysis, to gain a better understanding of the changes in the market over time in terms of price, production, perception of sales growth and inflation;
- Projections for enterprise growth, to predict changes in demand for the enterprises based on specific market drivers e.g. population growth, changing incomes, urbanization and consumer habits;
- Market volume analysis, to gain an understanding of the size of the market that is being studied e.g. volumes of the enterprises being traded within or through the markets;
- A web portal making important findings visual;
- A survey tool ready for repeat implementation.

2. METHODOLOGY

This chapter describes the methodology followed for the project, covering the area of interest, the data collection and sampling techniques and lastly data analysis and reporting.

2.1 SCOPE AND COVERAGE OF THE STUDY AREA

Geographically, the study was conducted within the boundaries of Kampala City, the capital and largest city of Uganda, which population is more than 1.5 million (2014 Census) and which has an annual growth rate of 4.03%. The city is located at 1,189m above sea level, and is spread over a total area of 189km^2, of which main land covers 176km^2.

As the study had an in-depth, qualitative focus, the number of urban farmers that could be interviewed was limited. To ensure that areas chosen for sampling are representative of the different populations involved, a geospatial analysis was done based on socio-economic factors on the study area to divide it up into similar areas, based upon which sampling could be spread accordingly and results extrapolated.

The city was thus divided into four categories. A total of 12 parishes were selected for the study (at least 2 from each category), from which data was collected from urban farmers. These parishes were randomly selected by the team, using a 'yes-card' pick method. The parishes chosen are Kyanja, Kikaaya, Ntinda, Salaama, Luwafu, Makindye I, Busega, Lubya, Kasubi, Mulago I, Kazo Angola and Kawempe II, were chosen from the four divisions of Nakawa, Makindye, Lubaga and Kawempe. Central Division was excluded for farmer interviews due to its limited farming and residential activities. Input suppliers, output processors and other stakeholders were interviewed across the City. The study focused on leafy vegetables and mushrooms grown and consumed in Kampala City upon KCCA's request.

A separate analysis was done on the percentage of green space per parish for the entire city using satellite imagery. This gives an indication of the type of urban farming practices that are suitable for that area and the potential overall space available.

2.2 SAMPLING TECHNIQUES AND DATA COLLECTION

The study used multi-dimensional data gathering including satellite imagery analysis and geospatial data analysis, together with community based participatory data collection approaches, and the Holtzman methodology which is a rapid assessment technique largely reliant on primary data collected from key informants who are knowledgeable about the given topic under investigation. The information gathered is subsequently triangulated to form a modest picture of the actual occurrence or situation under investigation.

2.2.1 REMOTE SENSING ANALYSIS AND GEOSPATIAL DATA

The selection of these areas of study was undertaken using a cluster analysis algorithm which utilized machine learning methods to determine natural groupings (most correlated) within the parishes basing on socio-economic indicators from the 2014 Uganda Bureau of Statistics (UBOS) Census. Using this algorithm, the parishes in Kampala were categorized into 4 groups based on where the following socio-economic parameters correlated most:

- Roof type of buildings, an indicator of wealth and permanency of a building
- Average age of citizens in the parish, an indicator of economic activity
- Population density, an indicator of available labor and wealth
- Type of dwelling, such as a tenement, servant quarters, detached house etc., an indicator of wealth
- Gender of the head of the household, an indicator of the type of farming generally undertaken

By finding the correlation and similarities between the parishes in Kampala, a dataset is created that allows conclusions and discussions about the socio economics statuses of the parishes in Kampala. This can be included, when reading and analyzing the result found in this report. The groups identified can be broadly characterized as:

- Group 1: older age, lower population density, more permanent roofs, more male-headed households
- Group 2: middle age, lower population density, more permanent roofs
- Group 3: younger age, medium population density, slightly more temporary roofs,
- Group 4: younger age, higher population density, more temporary roofs, fewer male-headed households

Figure 2 shows the result of the socio economic grouping of the parishes in Kampala.

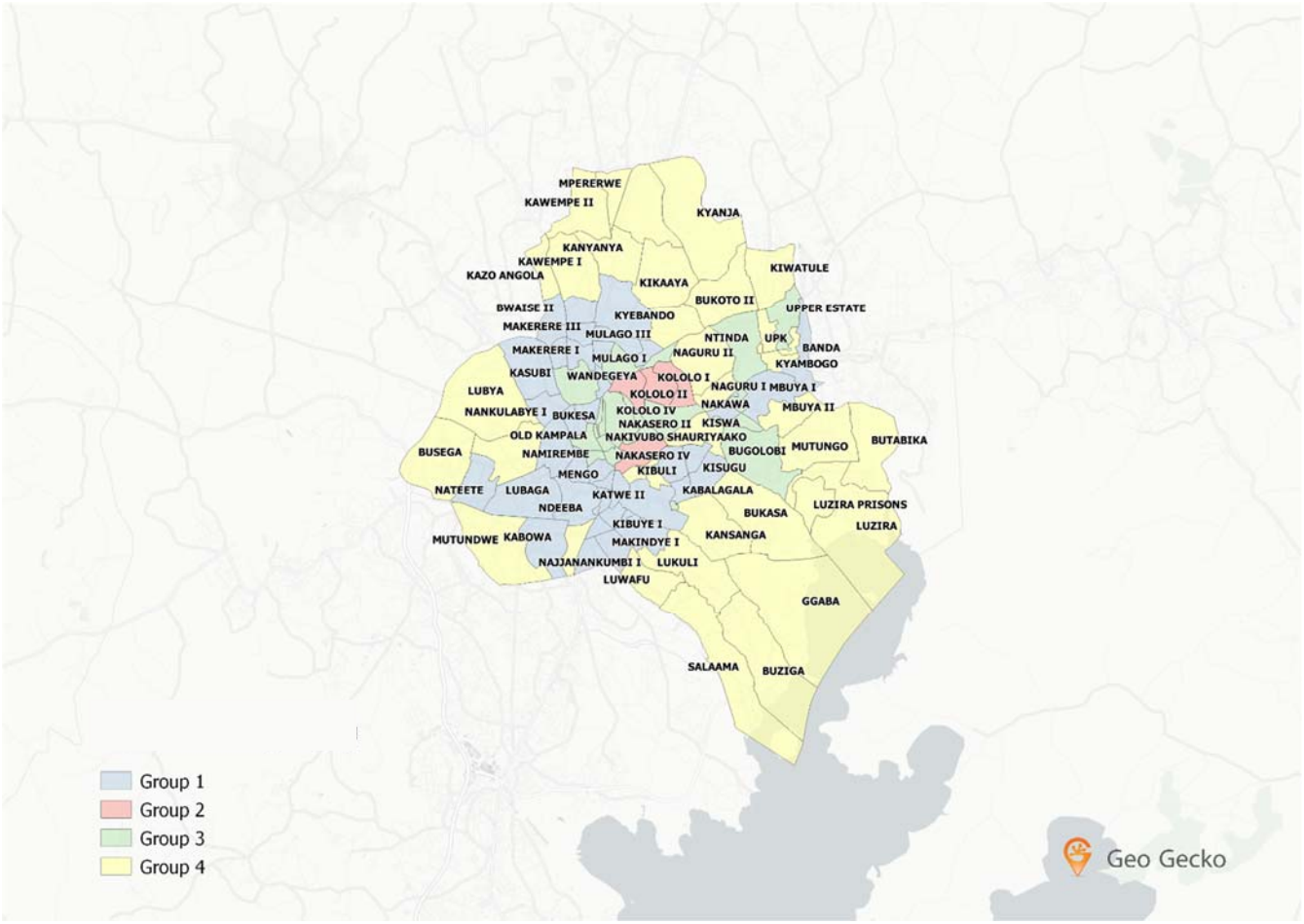


Figure 1 Socio economic grouping of Kampala. Source: UBOS Census, 2014.

Data was also collected on the available green space in all parishes of Kampala, to give an indication of the potential space for urban farming in each area. The green space analysis is based on satellite images from 2016 and 2018. The result quantifies the amount of green space in each parish for both years based on 10 x 10 meters pixels (the resolution of the satellite imagery that is freely available) that are classified as predominantly green or not. The result is presented in figure 3 below.

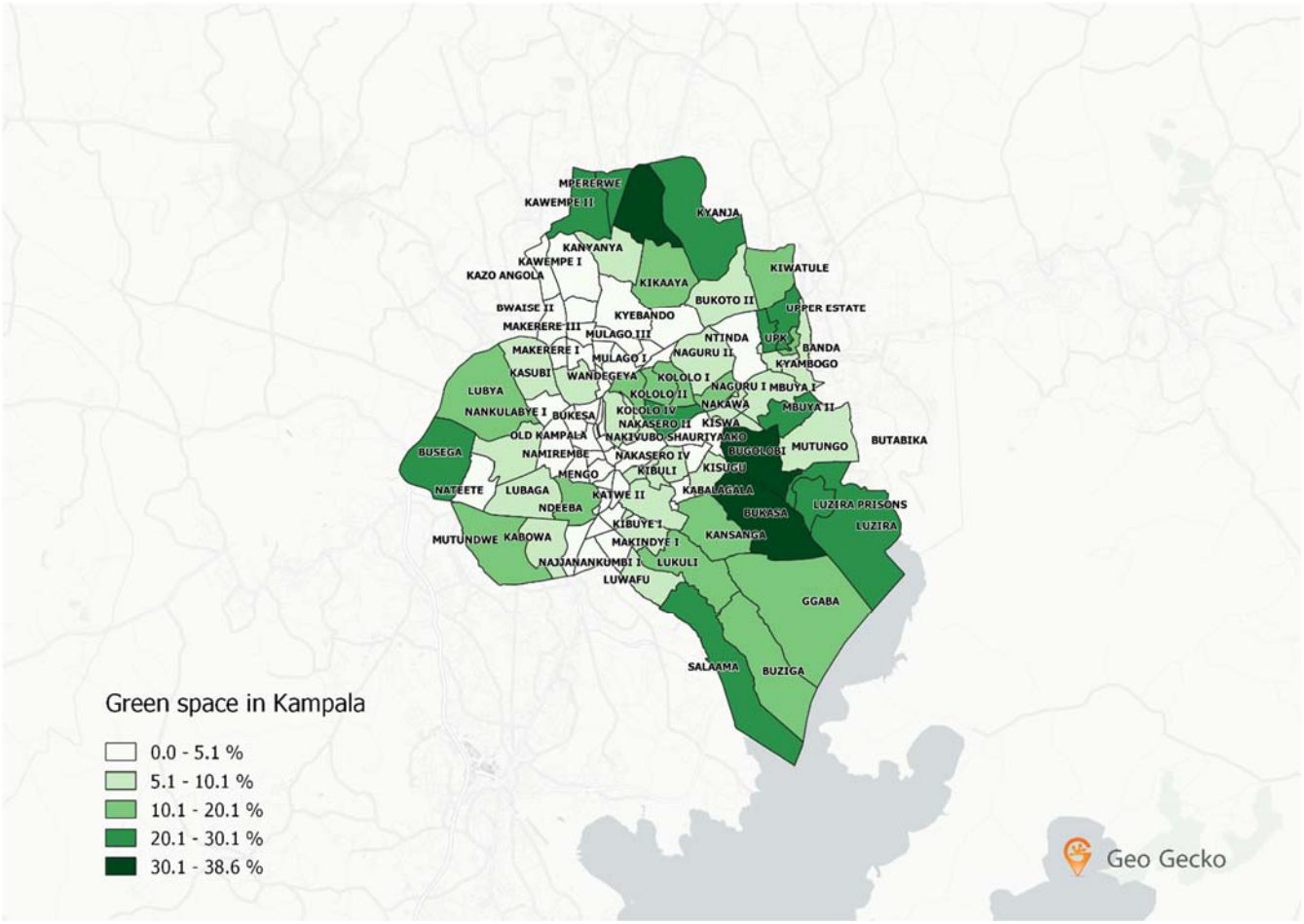


Figure 2 Amount of green space in the Parishes of Kampala. Source: Based on Sentinel data, 2018.

The above map shows a significant difference in the amount of green space between the parishes in Kampala. The three greenest areas of Kampala are Bugolobi, Bukasa and Kamamboga, while the less green spaces are located around Old Kampala.

2.2.2 THE COMMUNITY BASED PARTICIPATORY DATA COLLECTION APPROACH

Primary data was collected from urban farmers by holding 12 Focus Group Discussions (FGDs) with a total of 59 respondents, an additional 37 individual farmers, Key Informant interviews and personal observations. Secondary data was collected from KCCA Agri-Business staff and literature reviews. Figure 4 below displays the points where the different data was collected for this project.

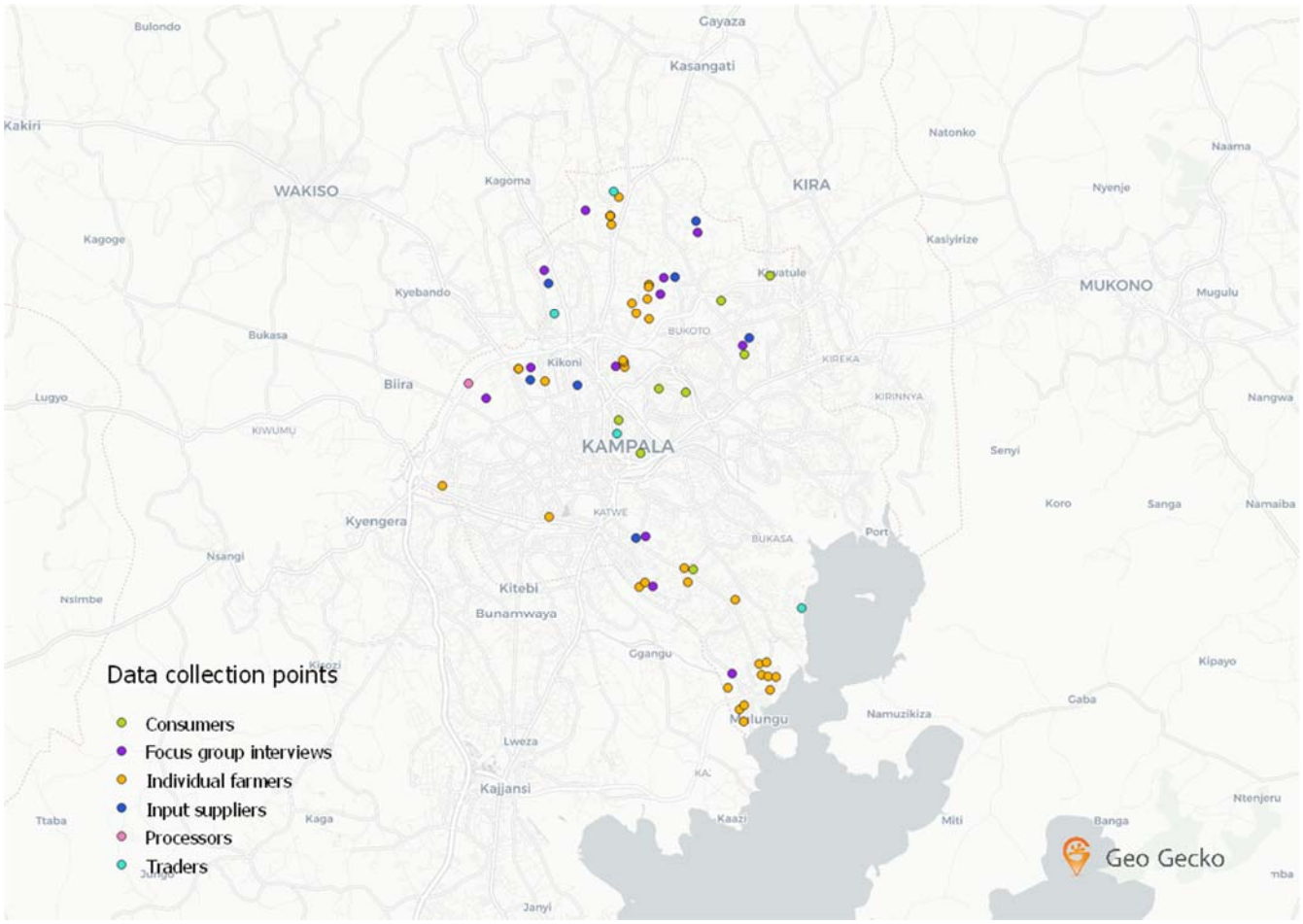


Figure 3 Data collection points for the project

Within the parishes selected for urban farmer surveys, the selection of the FGDs was based on 'purposive' and 'convenience' sampling among those involved in either growing leafy vegetables or mushrooms. Community leaders helped identify these farmers. Additional individual farmers were interviewed which were identified with the support of members of the respective FGDs, community leaders, input suppliers and traders.

Following the FGDs and individual farmer interviews, other actors in the value chains were identified and purposely selected across the city. These included 8 input suppliers, 6 traders, 4 extension service providers and 10 consumers (including 7 supermarkets, 2 hotels, & 1 corporate institution). A total of 30 key informants were interviewed.

The Kobo Toolbox was used to collect the relevant data from the field interviews and to access the data afterwards. Kobo is a free data collection system that consists of an App together with a webpage, where users can sign in and see the data collected on your projects. A closed-end structured questionnaire was specifically designed to capture all aspects of interest

from the FGDs and Key Informants and make that data analyzable. The tool and questionnaire are handed over to KCCA to allow repeat collection of data in the field of urban farming and to be able to track changes over time.

2.3 DATA ANALYSIS AND REPORTING

The data obtained during the survey has been analyzed quantitatively and qualitatively with the use of Microsoft Excel. Demand estimates and production projections were made using information obtained from the markets, whereas supply estimates were mostly based on the information obtained from producers (individual farmer respondents and FGDs). Subsequently key findings were identified and visualized into maps and graphs included in this report, which are shown in greater detail in the web portal.

The findings were compiled into this report first describing target group demographic characteristics followed by an overview of the mushroom and leafy vegetable value chains with a focus on their structure and dynamics, including primary factors driving the value chains and lead actors. Subsequently opportunities for upgrading the value chains are identified, a summary of the strengths, weaknesses, opportunities and threats related to support services, business enabling environment and value chain governance is given and finally recommendations on how these value chains can be improved.

3. SURVEY FINDINGS

This section presents the study findings, interpretations and discussions of the findings. It is divided into two sections: General socio-economic characteristics of the respondents and a description of the mushroom and leafy vegetable value chains.

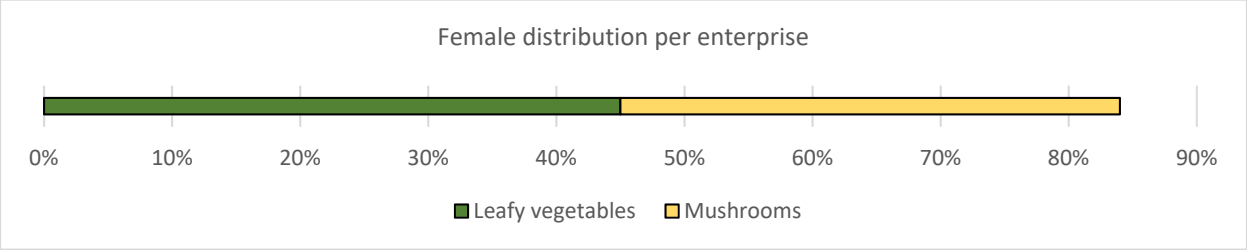
3.1 GENERAL CHARACTERISTICS OF THE RESPONDENTS

The total number of respondents interviewed was 126 as tabulated below in table 1.

Category of Actor	No. of respondents	Male	%	Female	%
Producers/Farmers (FDGs)	59	7	12	52	88
Producer/Farmers (Individual Interviews)	37	9	24	28	28
Input supplier	8	5	55	4	4
Processors	2	2	100	0	0
Traders	6	3	50	3	50
Consumers	10				
Extension service providers	4				
Total	**126**				

Table 1: No. of respondents by category of actors. See graphical representation in Appendix 1.

The following figures illustrates the characteristics of people the data was collected from. Figure 4 show the gender distribution across the enterprises.



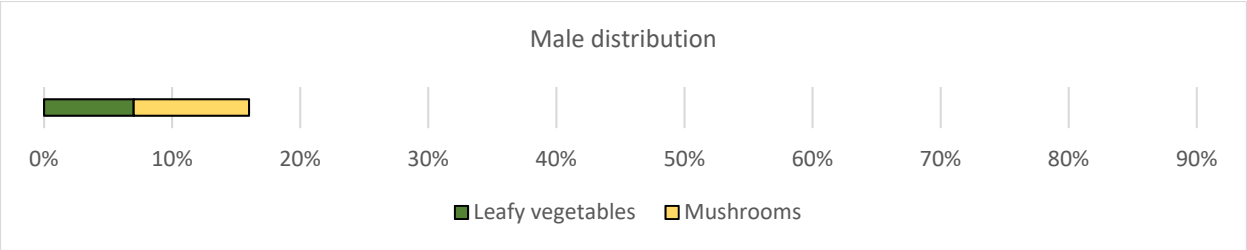


Figure 4: Gender distribution across types of farming in percentages

As seen in Figure 4, there is a trend of women being more engaged in farming activities. This can be related to a social gender practice, were women are majorly responsible to provide food for the household. where farming activities got more business orientated, more men were engaged in the activities.

Figure 5 show the educational level of the respondents in this project.

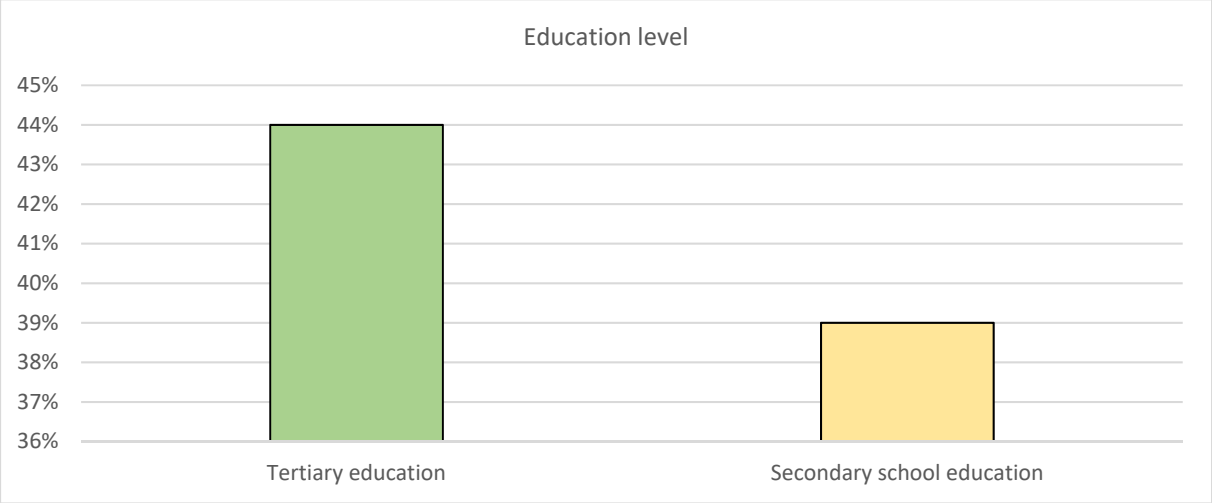


Figure 5 Educational level of respondents

Figure 5 below show the educational level characteristics of the respondents. As seen most respondents had a tertiary education. This gives them an opportunity to ably utilize available agriculture related information, which can be seen as an advantage.

Figure 6 show the status of land ownership of the respondents.

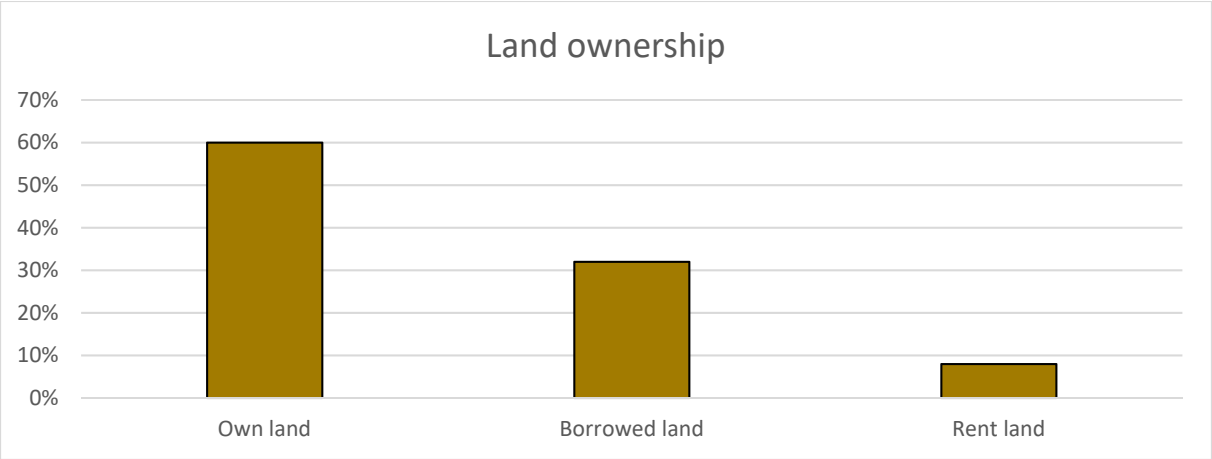


Figure 6 Status of land ownership among respondents

The status of land ownership among the farmers surveyed is shown below in figure 6. Date from this project shows that the status of land ownership influences the value chain. Where farmers owned land, they could easier invest in appropriate production technologies (e.g. soil fertility management). On the other side where farmer rented land there was a higher focus on the outputs rather than the inputs, because of the need for paying the rent for the land.

Finally, the purposes for which these urban farmers undertook mushroom and vegetable production included is shown in the below figure 7 and 8.

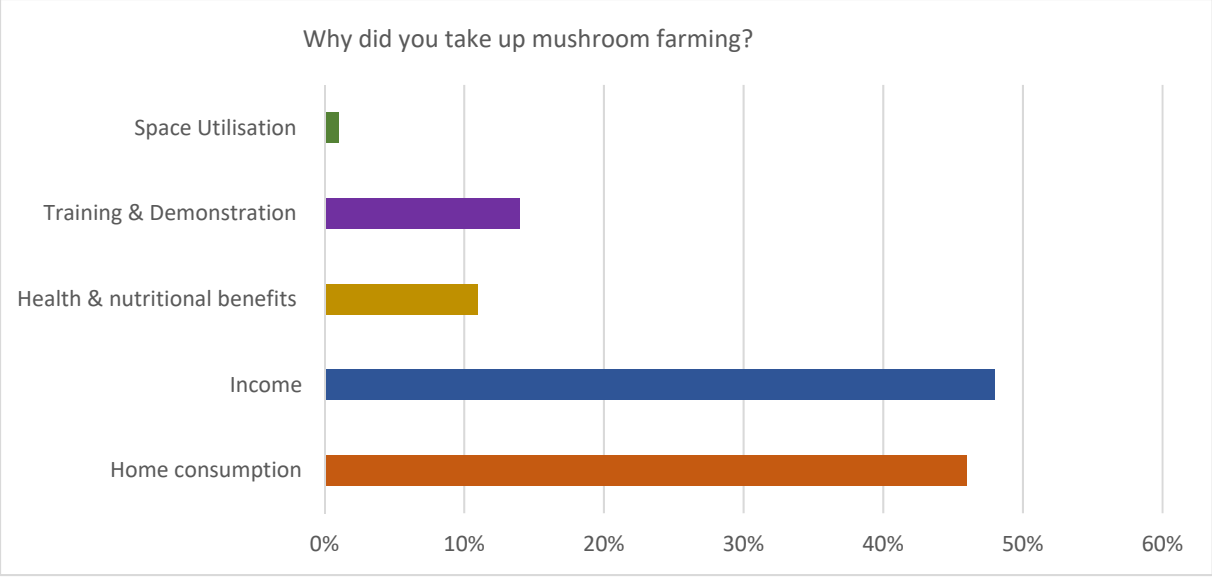


Figure 7 Why did respondents take up mushroom farming?

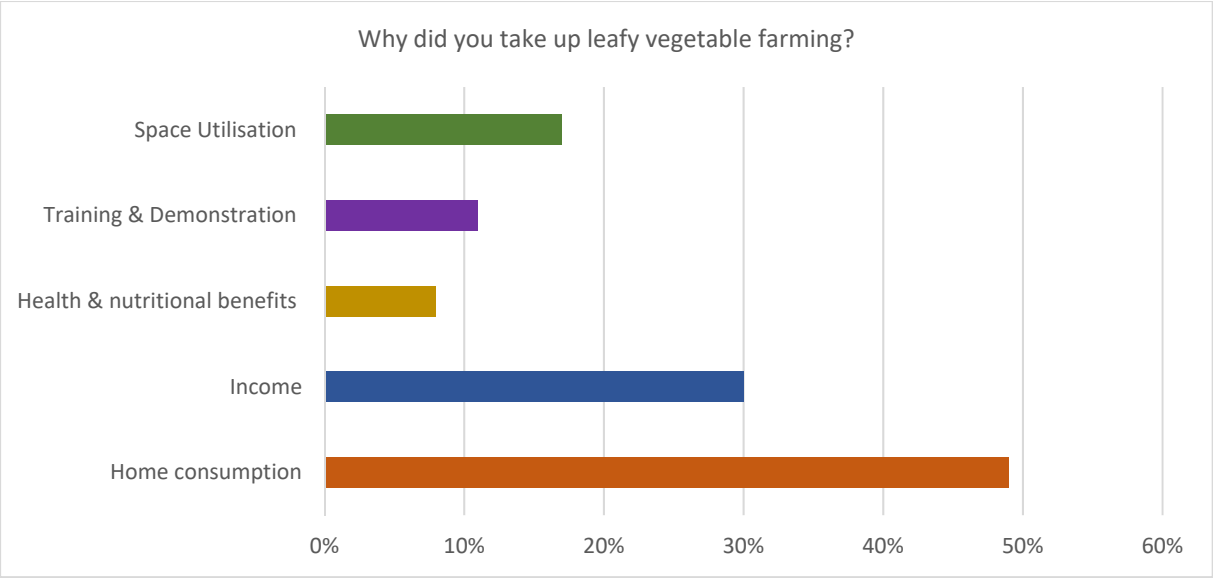


Figure 8 Why did respondents take up leafy vegetable farming?

The data shows that most farmers are most engaged in urban farming because of income generation and home consumption. For mushroom producers the major purpose was income generation, while it was home consumption for leafy vegetable producers. Furthermore, other purposes mentioned included gifting to friends, working from home, community beautification, as well as agro-tourism.

3.2 MUSHROOM AND LEAFY VEGETABLES VALUE CHAINS

This section covers an overview of the value chains, primary factors driving or blocking the dynamics of the value chain, lead actors in the value chain and opportunities to improve the products or processes within the value chain.

3.2.1 VALUE CHAIN OVERVIEWS

For each of the two enterprises of study, i.e. mushroom and leafy vegetables, the structure and dynamics of the value chain as systems, and the heterogeneity of the value chain actors are discussed as indicated in the flow diagrams below.

The mushroom value chain for Kampala is illustrated below in figure 9.

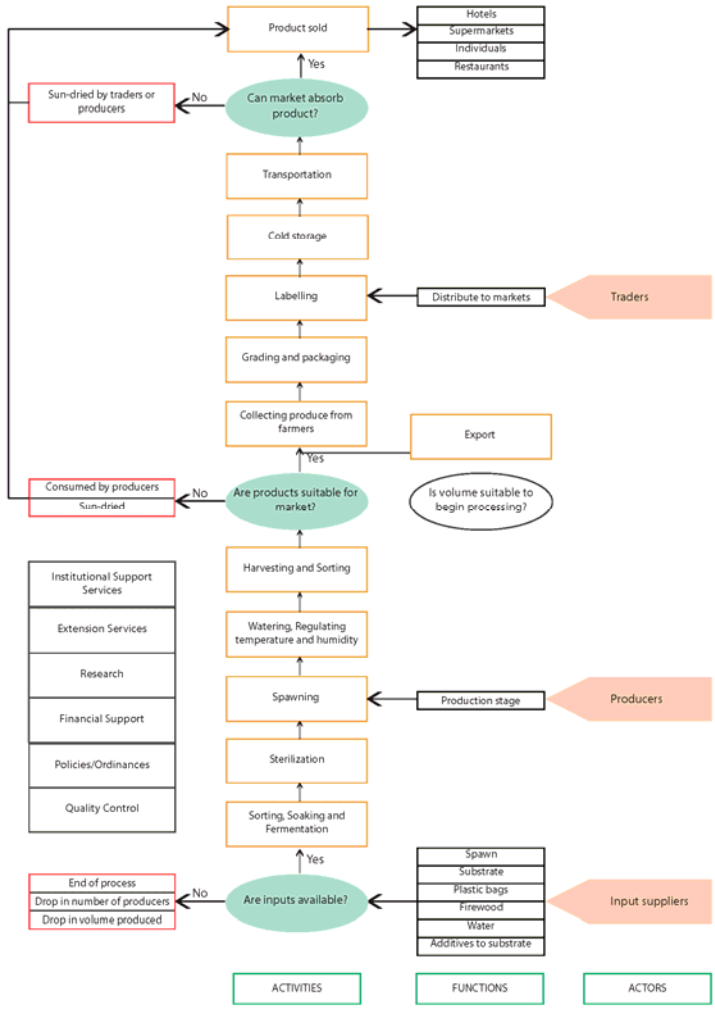


Figure 9 The mushroom value chain for Kampala

Its actors in Kampala City were generally categorized into input suppliers, producers, traders, processors and consumers. The main function and activities along the value chain are as shown in the figure 9 above. The major activities / functions of the mushroom producers included purchasing inputs, sterilizing substrates, spawning, regulating temperature and humidity, controlling pests and diseases, harvesting, transporting, drying and disposing of waste, as reflected in the above overview.

The leafy vegetables are one category of the horticultural crops grown in Kampala City. The commonly grown leafy vegetables include local variants such as nakati, sukuma wiki, bbugga, doodo, cortimil, jobyo, cabbage, spring onions and exotic vegetables such as Spinach, Chinese cabbage, Indian spinach, lettuce, parsley and celery. As for the mushroom

enterprise, the value chain actors were generally categorized into input suppliers, producers, traders and consumers. The main function and activities along the value chain are as shown below in figure 10.

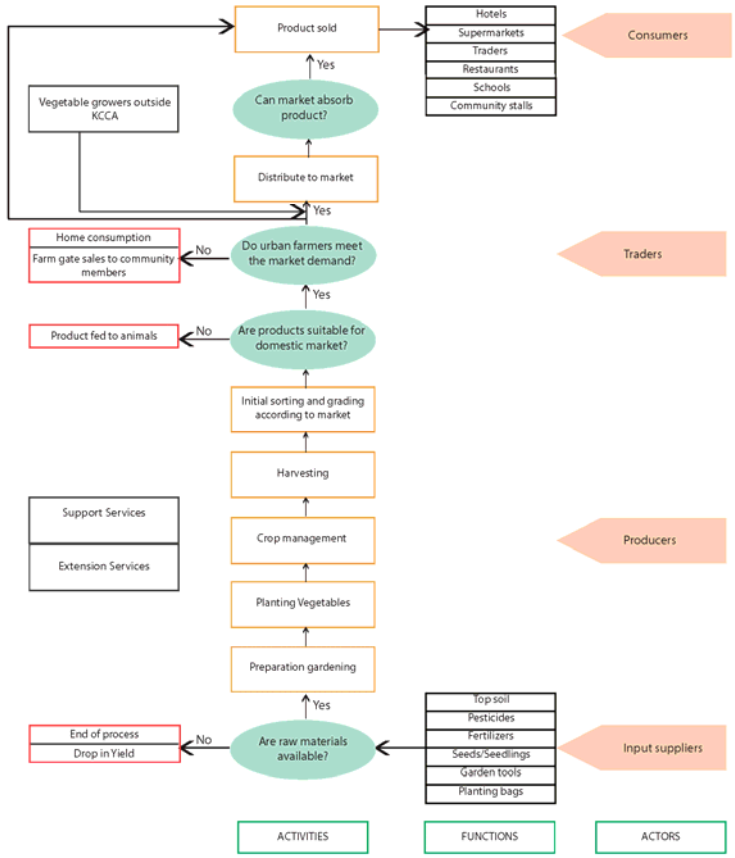


Figure 10 The leafy vegetable value chain for Kampala

3.3 PRIMARY FACTORS DRIVING OR BLOCKING THE VALUE CHAINS

Below the driving and blocking factors are detailed for the each value chains. Firstly, input supply and demand are discussed. This is followed by the value addition processes, support services and finally market potential. The sections are separated according to the two enterprises.

3.3.1 MUSHROOMS: INPUT SUPPLY AND DEMAND

During the study, major input suppliers for mushroom production were categorized as follows: spawn, substrate and substrate additives, water, plastics/growing bags and firewood.

SPAWN

There is currently no quality assurance system to regulate either the production of spawn or its movement in and out of the country. This leads to instances of low quality which does not satisfy farmers' expectations. The staff of some of the research and academic institutions with established laboratories were producing spawn using non-standardized processes, thus compromising quality. As a result, many private individuals have come up to produce their own spawn for their farms and the market. For this study three major institutions were identified as being Makarere University, Kawanda Agriculture Research Institute and Kyanja Agriculture Resource Center.

Although there are many spawn suppliers who have supported the growth of the mushroom industry in the last 20 years, there are a number of challenges faced by these suppliers including; the lack of guidelines to regulate the importation, movement and production of spawn; uncoordinated research on spawn production by the different institutions (Makerere University, National Agricultural Research laboratories - Kawanda (NARL) and Uganda Institute Research Institute (UIRI)), and lack of spawn production financing. There was no institution found that has prioritized investment in spawn production.

In addition, disconnects in supply and demand were found with farmers finding spawn unavailable when needed and suppliers complaining of last minute ordering and/or spawn expiring.

SUBSTRATE

The dominant substrate used for mushroom production by Kampala urban farmers is cotton seed husk. This is either procured directly from the cottonseed oil refineries or from traders. The cost of cottonseed husks fluctuates with cotton growing seasons which poses a threat to sustainable production. Major sources of these husks have been ginneries in Kasese, Lira, Masaka, Busunjju and Mityana. However, a number of these ginneries have changed the technology of extracting oil from the seeds. This has affected the availability of cottonseed substrate, thus constraining the farmers by increasing the costs. This is coupled with the dwindling growing of cotton in the country. To bridge this gap, some cottonseed husks are currently being imported from Tanzania. This is however of lower quality.

It should be noted that for everyone kilogram of dry substrate, the expected yield is one kilogram of fresh mushrooms. Therefore, with the estimated mushrooms consumed by the few markets visited during the study totaling to 13.6 tons per month, producers are required to purchase and stock at least 14 tons of substrate per month (at least 168 tons of substrate per year). The seasonality of substrate availability also partly explains the irregularity of spawn production. When the substrate is off-season, spawn demand suffers.

WATER

Water is a key input along the entire production stage. Its availability and quality are an important determinant for the productivity of the enterprise. The study noted commonly used sources of water by mushroom farmers included national water, rain water, sunken wells and swampy water. It was observed that farmers used more than one source of water for production. In some parts of the city, poor supply of national water was observed, e.g in Ntinda. Here the cost of water proved to be high, thus raising the cost of production. Secondly, the costs of a 20-litre jerry can of water from the natural stream ranged between Ug. 500 to 1,000. This limits production capacities (in terms of numbers of gardens). There is therefore a need to support alternative water systems, such as rain water harvesting and storage for production.

PLASTIC BAGS

Polythene bags are currently being used to package individual mushroom gardens. Should the current ban on such bags be strictly enforced, an alternative product will be required. In the interests of promoting environment friendly agriculture, it is advisable to promote an environmentally friendly alternative. Institutions such as the National Agricultural Research Laboratories-Kawanda (NARL), Makerere University (Faculties of Agriculture, Food Nutrition and Technology), and the Uganda Industrial Research Institute (UIRI) could play a role in identifying this alternative.

FIREWOOD

Sterilization of substrate is one of the key processes in mushroom production that, if not properly done, affects productivity. This process rids the substrate of the particular micro-organisms that would prevent mushrooms from growing, or other contaminants. This process requires firewood which is brought from outside the city as high cost. It is advisable to promote an alternative product for environmental, health and cost reasons.

3.3.2 LEAFY VEGETABLES INPUT SUPPLY AND DEMAND,

The paragraphs below focus on the five major input suppliers for leafy vegetable production identified during the study: fertilizer suppliers (organic and foliar), pesticides, top soil, water, and to a lesser extent seed & seedling.

ORGANIC AND FOLIAR FERTILIZERS

Most of the vegetable producers visited were using organic fertilizers in the form of chicken litter; a few individuals were using cow dung and manure. Most of this litter was purchased from poultry farmers not necessarily from the neighborhood,

at a rate of between Ugx. 6,000 to 10,000 per sack of approximately 130 kilograms. This was applied at planting. The farmers would also apply foliar fertilizers purchased from the agro-chemical shops mostly from the 'container village' outlets. They, however, expressed concern about the many foliar fertilizers on the market including identifying the most appropriate product for their need.

SEEDS/SEEDLINGS

Most farmers complained about the quality (viability and types) of the seeds purchased from the 'container village' shops. Since many of the farmers had small gardens, they resorted to multiplying their own seed (sowing seed from the previous season) or acquiring it from a fellow farmer.

When KCCA's Agricultural Resource Center in Kyanja was visited, it was evident that it has a variety of good quality leafy vegetable seedlings for sale. It has a capacity of producing 20,000 assorted seedlings per cycle and a demonstration of the different space-confined vegetable production technologies. This center is open for the general public every Wednesday and Saturday. However, of the individual farmers visited during this study, only 5% knew about the existence of the center and the services it offers, while only 2% had had an opportunity of visiting the center. And those who were aware of the center claimed that the supplies of seedlings were too low to ably supply the farmers' demands.

With the support of KCCA, which provided an enabling environment to private ornamental nurseries, farmers also accessed seedlings from road side nurseries in addition to ornamental plants. The quality of these seedlings could not be established. They are sold throughout the year along with the ornamental plants, which implies a growth in the vegetable production industry and thus the seedling demand.

PESTICIDES

A few farmers were using pesticides and fungicides from agro-chemical shops, while others use concoctions made at their farms to fight crop pests and diseases. Farmers complained that there are many types of chemicals, which do not always have the desired effects. Chemicals may be adulterated or mixed and/or dosed inappropriately. The indiscriminate use of toxic pesticides and chemical fertilizers is magnified by the lack of technical knowledge on the proper usage of such chemicals, which is feared to be causing health complications. There is therefore a need to introduce farmers to Integrated Pest Management methods.

TOP SOIL

A good number of farmers in the study (with small plots who used their residential compounds for farming), used top soil/black soil ferried from other sources for growing vegetables in their receptacle gardens. However, its quality greatly

depends on the source identified. Cost would depend on the location of the farmer and would range from Ugx. 100,000 to 150,000 for a two ton truck. It is important to note that city residents take the opportunity to grow vegetables even where there is very little open ground. If such farmers visited the KCCA's Kyanja Agricultural Resource Center, they would get even better idea on how to adopt space-confined vegetable production technologies.

WATER

Water is a key input along the entire production stage and drives the productivity of the enterprise. As with the mushroom farmers, the leafy vegetable producers commonly use natural streams, national water and swampy water for their vegetable production. The vegetable producers interviewed harvested both rain and surface water run-off for irrigation but lacked the knowledge and financial means to ably store this water to be used during the dry season.

3.3.3 MUSHROOMS: PRODUCTION, HARVEST & POST-HARVEST HANDLING AND PROCESSING

This section describes the production, harvest and post-harvest handling and processing for mushrooms.

TYPES OF PRODUCERS AND MAJOR ACTIVITIES

Most of the mushroom producers visited in the study area were individual farmers and there were a few producer groups. For purposes of this study, mushroom producers were operationally divided into 4 categories. Figure 12 shows the number of farmers interviewed in this project, that was engaged in the different types of farming.

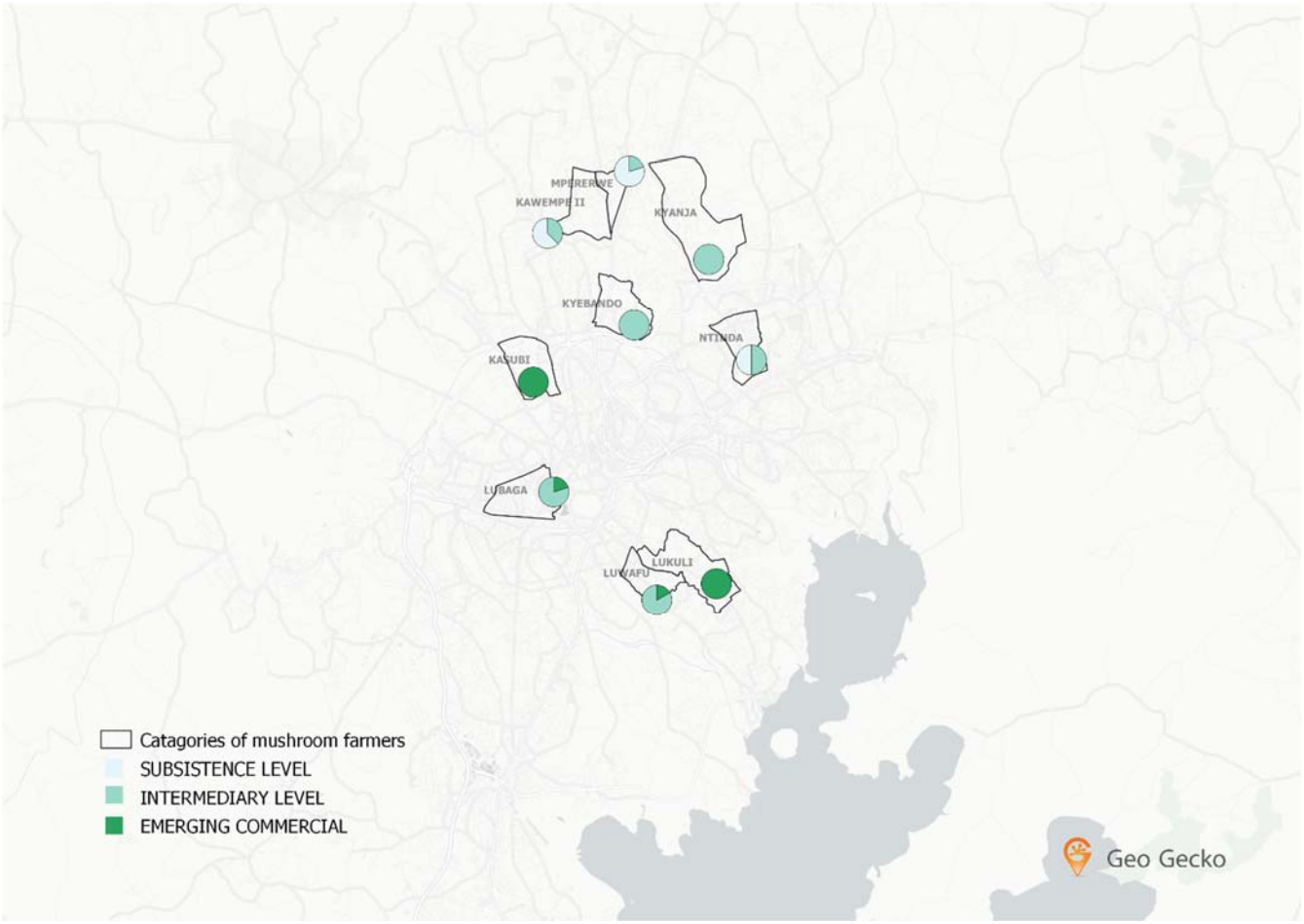


Figure 11 Category of mushroom farmer based on collected data

Subsistence level; Of the forty-six mushroom producers interviewed during the study, 41% of them were farming on a subsistence level and had less than 100 individual gardens each. The estimated total volume of mushrooms harvested by these farmers was approximately 150 kilograms per cycle of 2 months. Such farmers were commonly beginners, with home consumption as their main objective, while selling some to neighbor. They were not committed to growing these mushrooms continuously.

Intermediary level; These were 50% of the mushroom farmers surveyed, each having between 100 to 800 gardens. Their main objective was income and they were also inspiring others to undertake the mushroom farming. Unlike the subsistence farmers, they were committed to growing mushrooms all year round without breaking the production cycle. The estimated total volume of mushrooms harvested by the farmers was ranging between 150kg to 1,200kg per cycle.

Emerging commercial; Although these were very few, approximately 9%, their production ranged between 1,000 – 6,000 gardens each. These were another category of farmers whose production yielded up to 1,500kg to 9,000kg per cycle,

volumes that are far beyond what subsistence farmers would produce in a full year. Some of these producers also doubled as input suppliers (for spawn, substrate and growing bags, as well as traders).

Seasonal mushroom producers; Beside the above-mentioned types and illustrated on the map, there was another good number of seasonal mushroom producers, depending on available opportunities in the market and resources. Many of these would grow mushrooms during the rainy season when the humidity is high compared to the dry season where the humidity levels are low, and more water is required.

QUALITY OF PRODUCE

During the study, there were three major characteristics that farmers used as a measure of quality. With regards to compliance with quality standards, many of the farmers visited did not know of any guidelines on quality assurance. However, they had their customized standard requirements that they felt their products need to conform to and these included moisture content, stage of harvest and color of the mushrooms, explained as follows:

Moisture content; Mushrooms irrigated with ordinary drinking cups for humidification, were of a lower quality compared to those produced using spray pumps and foggers. A farmer requires much more water when using cups, than when using foggers or spray pumps

Time of harvest; The timing of harvest was considered another factor influencing the quality of mushrooms. Among the farmers visited, those who harvested overgrown mushrooms (more than 4 days after pinning), with spread out caps, had their produce perish faster than those who harvested on the 3rd day after pinning with hut-shaped cups.

Color of mushroom; According to the producers, the most preferred color of mushroom was the grey type. However, the color would vary with quality of spawn, temperature and humidity in the growing room.

Apart from the above requirements known to farmers, some traders complained about the dirt (unclean product), freshness of the mushrooms being traded and the relatively uneven sizes of the mushroom caps.

PRODUCTION TECHNOLOGIES

Common technologies used for production are both hanging strings and shelves, although some placed them on the ground laid with charcoal dust and gunny bags. To control temperature and humidity, most of the farmers used ordinary drinking cups, small buckets or watering cans for watering the mushroom gardens as well as maintaining the required level of humidity. A few used spray pumps and foggers. These humidity enhancing technologies had a great influence on the productivity and quality of the mushrooms produced. However, they are costly and not easily accessible for the intermediary and emerging commercial farmers.

WASTE DISPOSAL

Mushroom farmers generate two types of waste: used substrate and polythene bags. The bulk substrate was disposed of in different ways. The majority of farmers interviewed (84%), disposed of it in their gardens as manure, while some (23%) recycled it for cooking energy to supplement firewood. Only one farmer used the waste innovatively to breed worms for fish. Nearly all farmers (92%) disposed of the used polythene bags (growing bags) by burning them, while the remaining disposed of them on rubbish skips.

PROCESSING

Mushroom processing was not a common practice by the farmers apart from drying the harvest that has either not been sold or has expired on the shelves of the supermarkets. These dried mushrooms were either sold to consumers or made into powder form and used as food additives in porridge, groundnut sauce etc.

There were two processors interacted with, who made the following products: wines, juices, sauces, drinking powders and confectioneries, among others. It is important to note that volumes of these raw mushrooms used as ingredients in the processed products were not significant.

3.3.4 LEAFY VEGETABLES: PRODUCTION, HARVEST & POST-HARVEST HANDLING AND PROCESSING

TYPES OF FARMERS AND MAJOR ACTIVITIES

Vegetable farming in the area of study, took many forms, from home gardens on tiny plots using containers, to commercial producers on more than 275 **square** meters. Of the majority of the leafy vegetables producers interviewed, 46%, were subsistence farmers on land less than 50 square meters. The estimated total volume of leafy vegetables harvested could not be reliably established due to lack of records kept by farmers. With low start-up costs, especially for farmers on small plots of land, vegetable gardens provided essential food for households and often a surplus to be sold.

There was another category of producers, termed as the 'emerging commercial', who were basically growing their vegetables in the wetlands located in the periphery of the city, with plots ranging from 50 to 275 square meters. These producers constituted themselves into groups for collective marketing purposes and were selling most of their produce within the neighborhood markets, including Ggaba and Nakasero markets. Their estimated total volume harvested could also not be easily assessed due to poor record keeping culture. The estimated harvest per farmer is Ugx 600,000 to 800,000 every two months, depending on the season.

The major activities of the vegetable growers included purchasing inputs, land/garden preparation (making raised beds and different receptacle gardens), crop management, harvesting, initial sorting and grading of the produce according to the market requirements, as reflected in the value chain overview above.

PRODUCTION TECHNOLOGIES

Across the producers' spectrum, farmers were adopting, and adapting technologies suited to urban environments. The most common technologies used for production of leafy vegetables were open gardens, especially for those farming in the wetlands. This was followed by raised beds, kitchen gardens, and receptacle gardens including vertical farming, where vegetables were grown in containers that are stacked vertically (such as tyres, sacks, wooden racks etc). The majority of the farmers irrigated their crop using different methods. For those farming in the wetlands, during the rainy season, wetlands over-flooded making it impossible for them to continue in production. Therefore, they would be off-season during the rainy season, and in-season during the dry season. Irrigation water, in this case, was retrieved from the channels created in between the gardens. However, there are concerns about the health risks from the use of such water sources for irrigation. On the other hand, for those farming on regular land, the lack of irrigation facilities, caused inadequate production in their gardens. Irrigation played a major role for productivity and yields during the dry season. While some farmers try to use bottles for irrigation, this system has its limitations.

QUALITY OF PRODUCE

Most of the farmers visited were not conversant with any quality vegetable production standards, or any quality assurance guidelines. Instead, they have their own customized standard requirements they want their products to conform to and these included: the leaf color, plant vigor, moisture content and stage of harvest.

It was observed and appreciated that vegetables produced using the receptacle gardening methods gave a better quality of produce compared to vegetables grown on open ground, in the same area. This was evidenced by the height, vigor and leaf color of the plants. This could be attributed to the quality of soil used in the containers and moisture content in the soil.

The timing and frequency of harvest was yet another factor, influencing the quality of vegetables. Overgrown leaves tend to wilt faster than those harvested during the tender stage.

WASTE DISPOSAL

All the vegetable farmers visited during the study generated waste in form of vegetable stalks, leaves affected by pests and overgrown leaves. These wastes were mainly disposed of by returning them into their gardens for manure, although some farmers (25%) who also reared livestock, used the vegetable waste as livestock feed.

PROCESSING

There was no observed processing activity of vegetables mainly because:

- culturally, consumers prefer freshly prepared vegetables;
- demand for fresh vegetables is high, thus there is minimal unsold produce;
- there is a general lack of vegetable-processing skills and technologies.

3.4 SUPPORT SERVICE PROVISIONS

Service providers such as extension workers, Research & Development institutions, financial institutions, market information providers and local authorities are not in the mainstream of the value chain, but support and influence the functions of the value chains, as shown in figure 13.

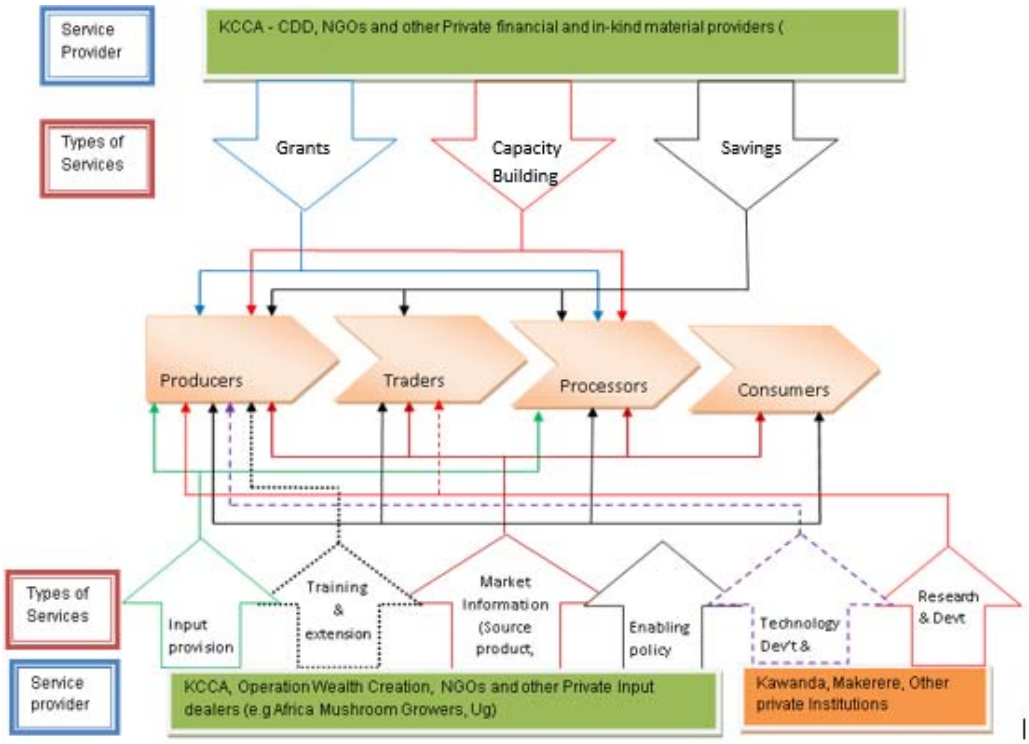


Figure 12 Support service providers for both mushrooms and vegetables

The following section explain the parts of these services and providers, that influence or can influence urban farming within Kampala.

3.4.1 TRAINING AND EXTENSION

Routine training and extension services to farmers are one of the key factors that influence their urban farming success levels. From the study, it was evident that such services were not adequately reaching the farmers. Some farmers informed the research team that they were not even aware of the existence of an Agricultural Extension service provision in KCCA. Common information sources are fellow farmers and radio and television programs (especially 'Seeds of gold') used by 60%, private extension services from Community Service Organizations (CSOs) used by 24%, Makerere and NARL used by 8%, KCCA used by 5%, social media used by 2%, whereas 27% used no source at all. In an interview held with the KCCA technical staff from the Directorate of Gender, Community Services and Production, it was evident that the workload was extreme and their capacity to respond was minimal.

3.4.2 PRODUCTION FINANCING

Production financing is also one of the ways of supporting the development of any business sector. Since mushroom farming is a rather new business enterprise in Uganda mainly practiced in Kampala, and urban farming has also just recently been accepted as a potential economic activity, all producers interviewed financed their enterprise (partly) through their own savings. Some mushroom farmers received grants from KCCA's Community Driven Programme (CDD), and the Presidential Initiative. Producers expressed the need to access credit facilities to grow their business, especially to support the acquisition of production technologies that regulate temperature and humidity in the growing rooms. No support from any financial institution was found among the farmers interviewed for either mushroom or vegetable production.

3.4.3 ACADEMIC INSTITUTIONS

Makerere University College of Natural Science has set up a training facility to develop skills to support modern mushroom production, but this facility has not yet been popularized among the mushroom farmers.

3.4.4 RESEARCH INSTITUTIONS

Key to developing mushroom farming is developing quality mushroom spawn. The National Agricultural Research Laboratories (NARL)-Kawanda under the Bio-spore project has undertaken research on different Oyster mushroom strains and is producing quality mushroom spawn for sale to farmers. However, their supplies do not meet farmers' demands. The

Uganda Industrial Research Institute (UIRI) is developing a business incubation program to support mushroom spawn production enterprises[6].

3.4.5 KCCA

KCCA has set up an Agricultural Resource Center at Kyanja, where it trains farmers in setting up and managing backyard gardens suitable for small spaces and produces and sells vegetable seedlings. As the authority that regulates agricultural activities in the City, KCCA developed a set of Urban Farming Ordnances to guide and regulate agricultural activities; and the Marketing & Trade order to regulate trade activities in the city. However, these ordinances have not yet been popularized among the farmers.

3.5 FINANCIAL ANALYSIS AT FARM LEVEL

This section discusses the investment cost for the two different enterprises as a gross margin analysis with production cost added to get an understanding of the working capital needs and some indication of gross profits. The section is separated into the two enterprises.

3.5.1 MUSHROOMS: INVESTMENT AND SALES

The minimum number of mushroom gardens recommended for a starting commercial farmer is 100 gardens weighing at least 2.5 kilograms each. A colonized, well-managed garden is expected to yield an average of 1.5kg within two months. Table 2 show the production costs for a mushroom project.

No.	**Item**	**Units**	**Unit Cost UGX**	**Amount UGX**
1	Mushroom Gardens (colonized pieces)	100	3,000	300,000
2	Transportation of inputs	1	20,000	20,000
3	Water costs for 2 months (humidification)	2	15,000	30,000
4	Labour	2	50,000	100,000
5	Packaging	1	10,000	10,000
6	Transport to Market	30	2,000	60,000
	Total			**520,000**

[6] Growing Uganda's Mushroom Farming : A Policy brief April 2017 www.agritt.org

Table 2 Production cost for a mushroom project

By investing the above it can lead to the sales explained below.

Fresh mushrooms (100 gardens) @ 1.5 kg	=	150kgs
Less 10% losses	=	15kgs
Total Output	=	135kgs

Price per kilogram ranges between 5,000/= - 8,000/=

i. At the lower selling price, the producer earns

135kg x 5,000/=	=	675,000/=
Less production costs	=	520,000/=
Gross profit	=	155,000/= (in a period of 2 months)

ii. At the higher selling price, the producer earns

135kg x 8,000/=	=	1,080,000/=
Less production costs	=	520,000/=
Gross profit	=	560,000/= (in a period of 2 months)

This is based on the following assumptions:

- A mushroom garden of 2.5 kg yields an average of 1.5 kg fresh mushrooms in a period of 2 months
- A producer is expected to have at least 4 mushroom growing cycles per year.
- For 100 mushroom gardens, a producer expects 150kgs of fresh mushrooms
- With an allowance of 10% for post-harvest losses, the producer remains with 135kgs
- Annual yield would be 135kgs x 4 growing cycles = 540kgs
- The current prices of fresh mushrooms range between UGx. 5,000 to 8,000 per kg
- Therefore, the annual gross income based on 540kgs would range between UGx. 2,700,000/= to 4,320,000/=,

3.5.2 LEAFY VEGETABLES: INVESTMENT AND SALES

For an emerging urban commercial vegetable farmer, the minimum recommended number of gardens or plots is four, with each plot measuring approximately 3x10 meters. Table 3 show the investment costs for production for leafy vegetables (Nakati)

No.	Item	Units	Unit Cost UGX	Amount UGX
1	Garden preparation & weeding (labor)	4	50,000	200,000
2	Seeds (ordinary plastic mugs)	6	5,000	30,000
3	Manure (bags of chicken liter)	3	10,000	30,000
4	Folia Fertilizer (300mls)	1	10,000	10,000
5	Pesticides / Fungicides	1	10,000	10,000
6	Water for irrigation	1	100,000	100,000
7	Transport (purchases inputs, marketing)	1	20,000	20,000
	Total			**400,000/=**

Table 3 Production costs for leafy vegetables (Nakati)

By investing the above it can lead to the sales explained below.

i. At the lower selling price, the producer earns = 600,000/=

Less production costs = 400,000/=

Gross profit = 200,000/= (in 2 months)

ii. At the higher selling price, The producer earns = 800,000/=

Less production costs = 400,000/=

Gross profit = 400,000/= (in 2 months)

This is based on the following assumptions:

- Each plot is expected to yield vegetables worth Ugx. 150,000/= (rainy season) and 200,000/= (dry season) in a period of two months
- Therefore, 4 plots (gardens) are expected to yield vegetables worth 4 x (150,000 /= - 200,000/=) totalling to Ugx. 600,000/= - 800,000/= in two months
- A producer is expected to have at least 4 vegetable growing cycles per year
- This would generate an gross annual income from 4 growing cycles of 4x(600,000/= - 800,000/=) ranging between Ugx. 2,400,000/= to 3,200,000/=

3.5 MARKET STRUCTURES

The following explains our findings related to the market structures of mushrooms and leafy vegetables within Kampala. The section is separated into the two enterprises.

3.5.1 MUSHROOMS: TYPE AND SIZE OF MARKET BY LOCATION

Mushroom farmers in the study area, mainly produced the Oyster variant, which were commonly sold to Nakasero market, hotels, supermarkets, restaurants and to households in their neighborhoods. The volumes of mushrooms produced by the 46 producers interviewed are estimated at 7,152 kilogram per month total which is worth Ugx.35,760,000/=, (that is 85,824kgs per year worth Ugx.429,120,000/=), although these producers did not keep proper records. The major markets interacted with during the study consumed an average of 13,600kgs of mushrooms on a monthly basis. These were two hotels which consumed an average of 560kg per day and seven supermarkets which consumed an estimate of 600kg per week.

As the hotel market comes out as such a large consumer below map in figure 14 shows where other large hotels are located that are likely to have similar demands for mushrooms. Data about consumption was collected from Kabira Country Club and Protea Hotel by Mariott.

Figure 13: 3 - 5 stars hotels in Kampala. Data was collected from Protea by Mariott and Kabira Country Club. Similar hotels source: Google Maps

It was also observed that there were other types of mushrooms on the market, (e.g. Button, Portobello and King Oyster) imported mainly from Rwanda, Kenya and South Africa, that were competing with the Oyster mushrooms. It was established from the study that there is still a great demand for mushrooms most notably the Button type.

3.5.1 LEAFY VEGETABLES: TYPE AND SIZE OF MARKET BY LOCATION

Commercial urban farmers in Kampala are also growing specialized vegetables for niche markets such as the Chinese, Indian, Sudanese, Ethiopian and Congolese foreign communities. Some of these specialized vegetables were sold to supermarkets and restaurants, while the local vegetables grown are being sold at farm-gate and to other consumers (including schools and health centers). The volume of the vegetables grown by the producers visited were estimated at a worth of Ugx.1,600,000/= per month, although these producers lacked proper records. However, it was revealed in the study that there is still a large market for vegetables in Kampala, which is currently not satisfied by the urban farmers. This market is

being supplied by producers from outside the city. Figure 14 illustrates the flows of leafy vegetables into the market in Kampala.

According to Jagwe (2016)[7], in a study on "Demand and Supply of African Indigenous Vegetables in East and Central Uganda",

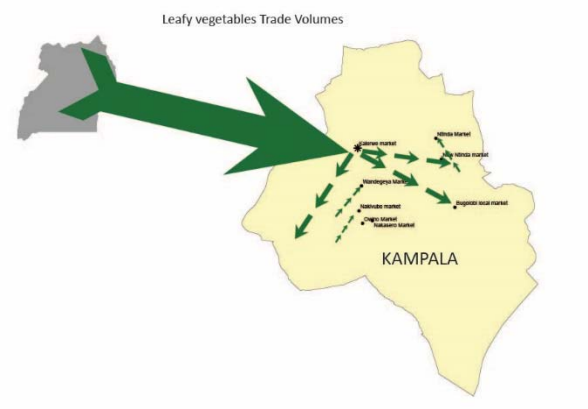


Figure 14 Flows of leafy vegetables into the market in Kampala

400 bundles of vegetables were being traded daily at Kalerwe market; and each bundle was estimated at 200KG totaling an estimated 80 tons. An interview with the market supervisor of the vegetable section revealed that Kalerwe acts as a market hub for a variety of leafy vegetables, coming in from different neighboring districts, most notably Wakiso and Luwero. Vegetables traders from other city market such as Nakasero, Bukoto, Nakawa, Gaba, among many others, buy leafy vegetables from Kalerwe market. It was also established from the study that, there is still a great demand of more than 600 bundles (estimate of 120 tons) of leafy vegetables daily.

3.6 DISTANCE TO MARKETS AND MARKET CHANNELS

Transporting of leafy vegetables and mushroom is an important factor to consider when assessing potential. One must balance the transportation of goods and the potential market size, combined with the potential for farming activities in certain areas. The below map, in Figure 15, shows the level of access to Kampala markets. This is calculated by carrying out a network analysis between the entire city and each market.

[77] Jagwe J.N., Kasozi M. and Luwandagga D., 2016. *Demand and Supply of African Indigenous Vegetables (Solanaceae sp) in East and Central Uganda*. Study report produced for UCU, Farmgain Africa, CHAIN and NRI consortium in Uganda with funding from European Commission through PAEPARD-FARA, October 2016.

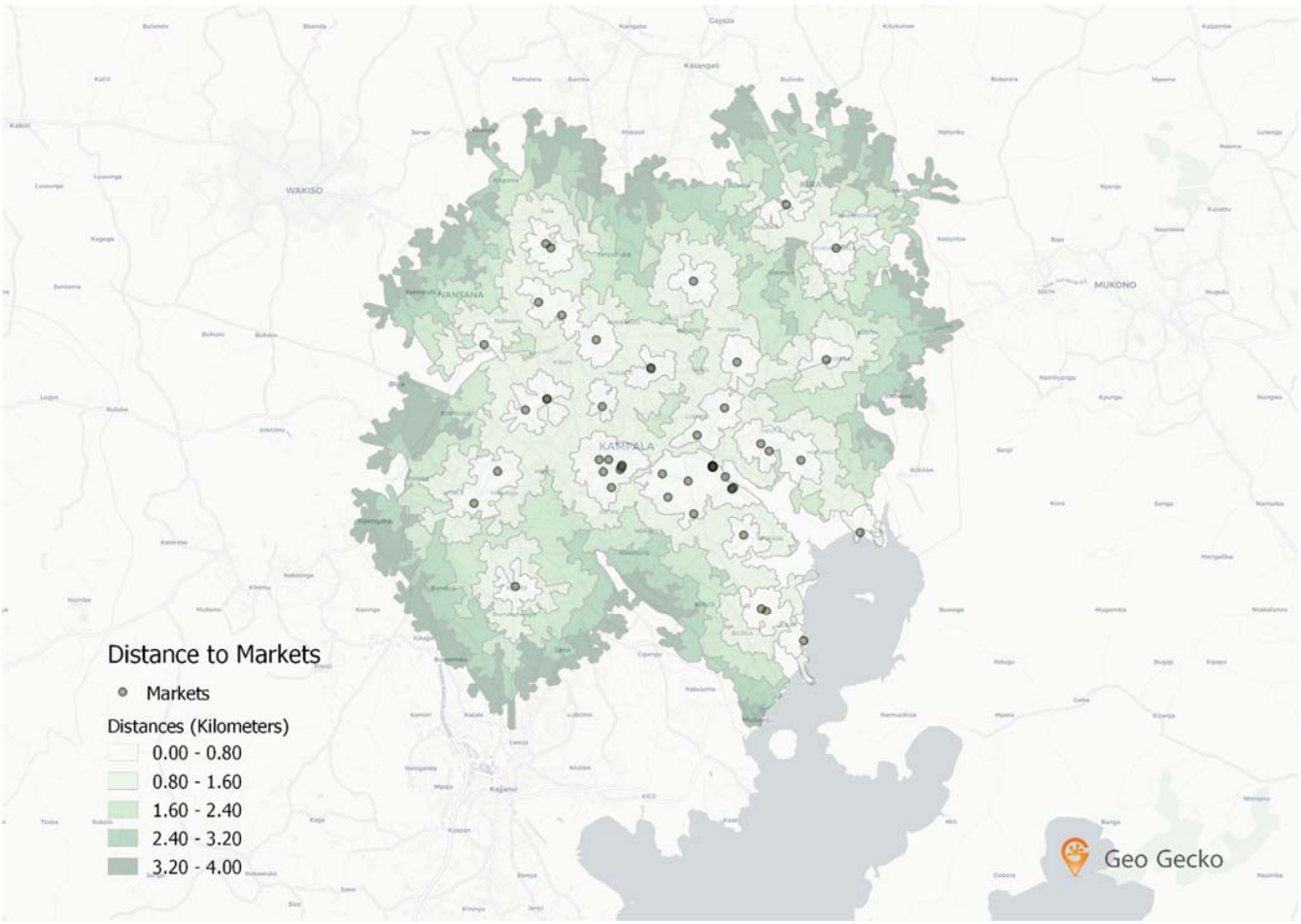


Figure 15 Result of distance to market analysis for Kampala. Market data is based on available data from OpenStreetMap

When considering the above map with the map in Figure 2 (green space), we see a pattern that most available green space is located in areas furthest from the markets. This means that the potential to producing in these areas is dependent on the availability to transport the goods to a distant market.

3.6.1 MUSHROOM MARKET CHANNELS

The mushroom value chain actors added value when the produce passed from one actor to another. The actors changed the form of the product by either improving the grade through sorting and cleaning and/or via branding. The flow diagram below in Figure 16 gives an indication of the mushroom market channels in the study area.

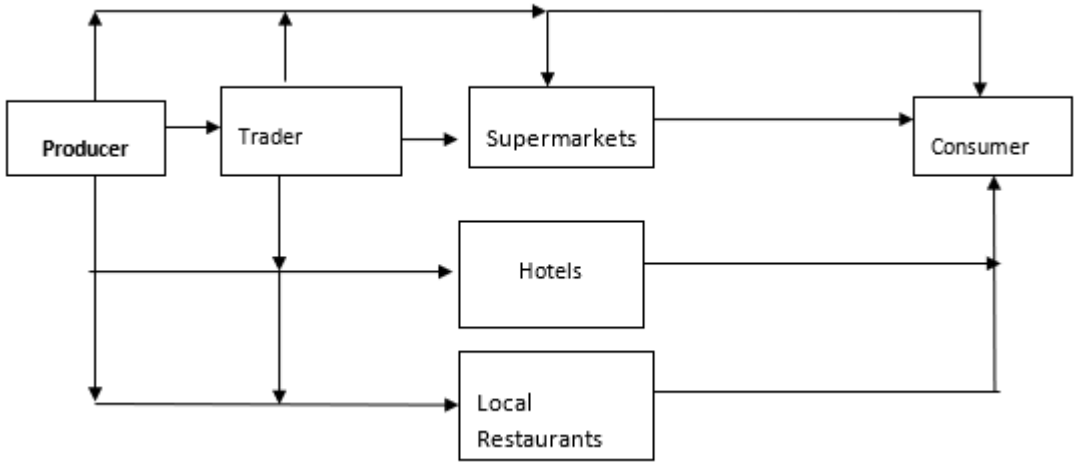


Figure 16 Mushroom market channels deduced from the study

3.6.1 LEAFY VEGETABLES MARKET CHANNELS

The leafy vegetable value chain actors added value when the produce passed from one actor to another. The actors either changed the form of the product by improving the grade through sorting, cleaning and/or tying the vegetables into smaller affordable bundles. The market channels in the study area are as indicated in the flow diagram below in figure 17. The first diagram shows the market channels from the fringes of Kampala, while the second one in the figure 18 show the market channel the Kampala urban farmers.

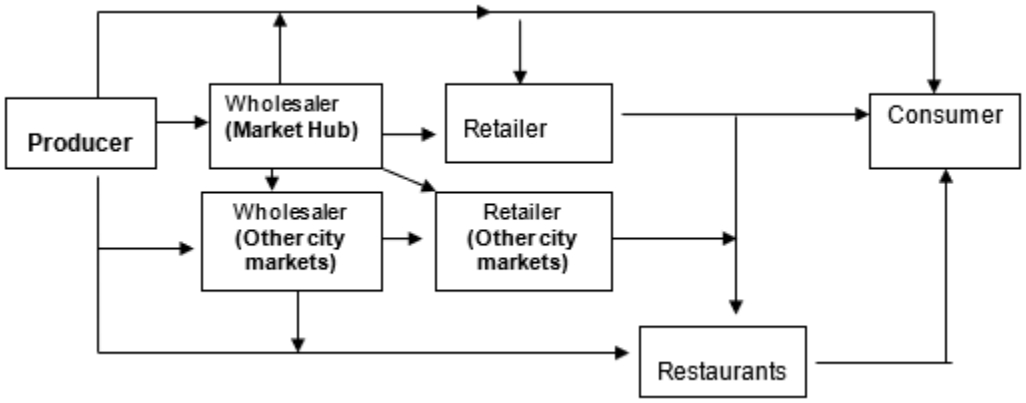


Figure 17: Leafy vegetable market channels (from the fringes of Kampala)

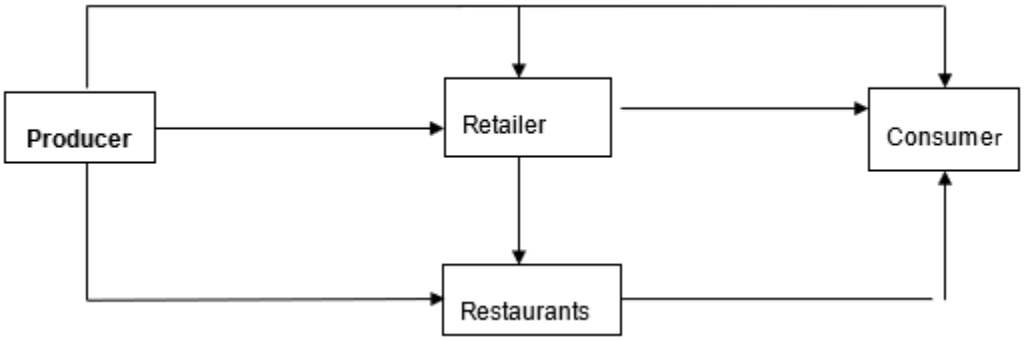


Figure 18: Leafy vegetable market channels (from Kampala urban farmers)

3.7 VALUE ADDED ALONG THE VALUE CHAIN FOR MUSHROOMS & VEGETABLES

Figures 19 & 20 visualize the value added along the value chain for both mushrooms and vegetables.

It is important to note that:

- For mushroom production, the producer adds value by pooling together all the inputs required for mushroom production and by the actual growing of the crop
- Cost of production for one kg of fresh mushrooms is 520,000 divided by 135 gardens = 3,850
- The range of prices varies with demand and seasons

While,

- Production of leafy vegetables refers to what the producers undertake in pooling together all the required vegetable production inputs and actually growing the crop
- One bundle of leafy vegetables ranges from 12-15 leaves depending on vegetable type and season.
- Cost of production for one bundle of vegetables (12 – 15 leaves) was estimated at 500
- The range of prices varies with demand and seasons

Mushrooms	**Input supplier**	**Producer**	**Trader retail / Trader restaurent**	**Consumer**
Selling price/kg	NA	5,000 to 8,000	6,500 to 7,000	7,000 to 10,000
Purchase price/kg	NA	3,85	5,000 to 6,000	6,500 to 7,000
Profit/kg	NA	1,150 to 4,150	500 to 2,000	0 to 3,500

Value added	Producing ready-made mushroom gardens	Production	Bulking	Re-packaging
		Harvesting	Transportation	Branding
	Training farmers	Cleaning and sorting	Sorting and re-packaging	Cooling
		Packaging		Preparing mushrooms in different meals

Table 4: Value added along the value chain for mushrooms

Leafy vegetables	**Input supplier**	**Producer**	**Trader retail**	**Trader restaurent**	**Consumer**
Selling price/bundle	NA	1	1,5	4	NA
Purchase price/bundle	NA	500	1	2	1,500 to 3000
Profit/bundle	NA	500	500	2	NA
Value added	Seeds	Production	Bulking	Re-packaging	Re-packaging
	Seedling	Harvesting	Transportation	Branding	Preparing vegetables in different recipes
	Top soli	Cleaning and sorting	Sorting and re-packaging	Cooling	
	Pesticides	Packaging		Preparing mushrooms in different meals	
	Fertilisers				

Table 5 Value added along the value chain for leafy vegetables

3.8 MARKET TRENDS ANALYSIS FOR BOTH MUSHROOMS AND LEAFY VEGETABLES

In order to gain a better understanding of the changes in the market of mushrooms and leafy vegetables over time, prices, production, perception of sales growth and inflation were discussed during the FGDs held with the eleven groups of farmers.

Table 6 below gives an indication of the increasing demand for mushrooms and leafy vegetables over the last three years. The table illustrates a representative average farmers' monthly income, over a period of three years

Years	Average monthly product sales (UGX)	
	Mushrooms	**Vegetables**
2018	3,420,000	1,600,000
2017	2,665,000	790,000
2016	980,000	635,000

Table 6: A representative average farmers' monthly income, over a period of three years.

These two products present an opportunity for urban farmers to increase their incomes if they can meet the demands of the traders in terms of quality, quantity and sustainable production. Demand also exists for vegetables and mushrooms variations other than those being currently produced. For example, there is a demand for Button mushrooms and vegetables for foreign communities. Supply of mushroom and leafy vegetables produced by urban farmers does not meet the demand of traders and consumers.

The study interviewed 46 mushroom growers with an average total of 21,431 gardens every 3 months. If they produced all year round, they would grow 85,724 gardens per year of 2.5kgs each. Assuming each garden yields at least 1kg (at the lowest), the annual production from these gardens can be approximately 85,724kgs

3.8.1 DEMAND FOR MUSHROOMS AND VEGETABLES

Traders

Four traders were handling a volume of 410 kg mushrooms per day but had a demand of more than 500kg mushrooms per day. This meant an average demand of 120,000 kg per year (500 x 20days x 12 months, weekends exclusive).

For the fifty vegetable growers interviewed, their average monthly volume had risen to a financial equivalent of UGX 1,600,000 in 2018 from UGX 635,000 in 2016. However, as discussed earlier, these volumes are far too low to satisfy the demand of the city markets.

Consumers

A total of ten major mushroom consumers were visited, and their consumption levels were 6,188kgs per month, totaling 74,256kgs per year. The major consumers/buyers were supermarkets and hotels.

The major vegetable consumers visited were the city markets, and their consumption comes to an average of 1,600 bundles per year. This explains why most of the vegetables are procured from rural districts where supplies are sufficient and more

reliable. As much as the vegetable farmers meet the requirements of quality and price, they are unlikely to meet the additional quantities demanded by the market. The feasible alternative is for these farmers to confine themselves to the niche markets (most promising markets) which they can supply easily with the present production space.

Unlike the vegetable farmers, mushroom farmers, if supported technically and financially, can meet the requirements of quality and sustainable supply for the Kampala city market. Their physical proximity to the market gives them the extra advantage of being able to supply fresh mushrooms in a timely fashion.

The prices of leafy vegetables and mushrooms have remained relatively stable during the previous three years, but the cost of inputs have increased, almost doubling the production costs, thus resulting into reduced farmers' profit margins.

3.8.2 MUSHROOM PRODUCTION PROJECTIONS

The following table 7 show some projections of the mushroom production.

Description of Consumers	**No.**	**Daily demand (kg)**	**No. of days /month**	**No. of months**	**Annual Potential Demand (kg)**
Hotels in Kampala (3-5 star)	30	10	20	12	72,000
High end Supermarkets	10	10	20	12	24,000
Low end Supermarkets	20	5	20	12	24,000
Small restaurants	50	3	20	12	36,000
Informal markets	100	2	20	9	36,000
Home consumption	200	1	4	12	10,400
				Total	**202,400**

Table 7: Projections of the mushroom production

The table is based on the following assumptions

- There are more than thirty 3-5 star hotels in Kampala City
- If thirty hotels in Kampala, at the level of 3 - 5 stars consume an average of 10kgs per day, for 20 days a month, this would amount to **72,000kg** per year i.e.(30 hotels x 10kg x 20 days x 12 months)
- If ten high-end Supermarkets in Kampala consume an average of 10kg / day for 20 days a month, this would total **24,000kg / year** i.e. (10 supermarkets x 10 kg x 20days x 12 months)
- If twenty low end supermarkets in Kampala consume an average of 5kg / day for 20 days a month, this would total **24,000kg / year** i.e. (20 supermarkets x 5 kg x 20days x 12months)
- If fifty small restaurants and other fast foods eating places across the Divisions of Kampala[8], consume 3kg per day for 20 days a months, this would total to **36,000kg** / year. (i.e. 50 restaurants x 3kgs x 20 days x 12 months)
- If 100 families in the city, produced and supplied their mushrooms in the informal markets and can supply an estimate of 10kgs of fresh mushrooms per week and we made an allowance of 4 months for re-stocking, then in a year they would be left with 9 months of production (equivalent to 36 weeks). Thus they would be having a potential of producing at least **36,000**kgs of fresh mushrooms per year
- Home consumption: if 200 families were producing mushroom and each family consumes 1kg of fresh mushrooms for consumption on a weekly basis, this would total to **10,400kg** per year
- To sustainably meet the demands of mushroom consumers as detailed above totaling to **202,400kgs,** KCCA would need at least 375 committed farmers, each growing an average of 100 mushroom gardens for four cycles annually
- The total value of such an intervention would be **Ugx.1,012,000,000/=** (202,400kg x 5,000/=) However, this can ably be achieved within a period in three years

3.8.2 LEAFY VEGETABLES PRODUCTION PROJECTIONS

The following table 8 show some projections of the leafy vegetables production.

Description of Producers	No.	No. of cycles	Potential value per cycle	Annual Potential Value UGX
Identify five youth groups of 50 members each	5	4	5x50x600,000 = 150,000,000	150,000,000 x 4 = 600,000,000
Identify five women groups of 50 members each	5	4	5x50x600,000 = 150,000,000	150,000,000 x 4 = 600,000,000

Table 8 Projections of the leafy vegetables production

The table is based on the assumptions that Kampala vegetable growers can target the niche markets provided by the foreign communities (Chinese, Indians, South Sudanese, Ethiopians and Eritreans) that demand specialized vegetables. As

[8] http//www.tripadvisor.com

vegetables can be grown and transported from outside districts like Luwero, Wakiso, Mukono which are more than 50km from Kampala, there is great potential for farmers in Kampala to profit from vegetable growing.

- If 5 youth groups of 50 member each are identified from every division to produce leafy vegetables on four plots of 30 square meters each
- If 5 women groups of 50 members each are Identified from every division to produce leafy vegetables on four plots of 30 square meters each
- If they can sustainably commit to growing vegetables four cycles per year.
- If KCCA identifies land to lease to potential vegetable growers
- If farmer cooperatives are strengthened to support its members with production skills and drip irrigation kits
- Then on average, a farmer on four plots of 30sqm can produce vegetables worth UGX600,000 per cycle of 3 months; the value can vary depending on the type of vegetable grown
- The total value of such an intervention would be **UGX1,200,000,000** (UGX600,000,000 youths groups + UGX 600,000,000 women groups). This can ably be achieved within a period in three years.

4. STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS

The Strengths, Weaknesses, Opportunities and Threats (SWOT) tool was used to analyze the data generated from different actors in the value chains. It facilitated an overview of each actor's position within the value chain in order to propose interventions and upgrading opportunities for enterprise growth. It further provides a framework for understanding controllable and non-controllable factors that future interventions should address for the entire value chains. In designing possible interventions, it is suggested that development practitioners and policy makers place emphasis on exploiting the outlined strengths rather than simply addressing weaknesses. Similarly, the opportunities and threats - the external trends that influence the subsector - are also suggested to be taken into account.

4.1 SWOT ANALYSIS OF THE MUSHROOM VALUE CHAIN

It is important to note that the key input suppliers considered in this table include spawn and substrate suppliers.

Mushroom VCA Strengths				
Input Suppliers	***Producers/Farmers***	***Processors***	***Traders***	***Consumers***
There are many spawn suppliers supporting the growth of the mushroom industry, already for 20 years	Middle and low income earners in Kampala city are practicing mushroom growing	Wine made out of mushrooms has a ready market.	The price of imported mushrooms is higher than local produce Availability of infrastructure esp. roads, to ably transport the highly delicate produce	Increased awareness of the nutritional value mushroom products
Mushroom VCA Weaknesses				
Input Suppliers	***Producers/Farmers***	***Processors***	***Traders***	***Consumers***
Production of poor quality of spawn Inadequate access to quality mushroom mother cultures and substrate Lack of guidelines to regulate the importation, movement & production of spawn Uncoordinated research on production spawn by the different institutions (University, UIRI) Lack of spawn production financing	Quantities of mushrooms produced by urban farmers is still small and unable to produce sustainably Weak linkage and cooperation among producers Lack of appropriate post-harvest handling facilities since mushrooms are perishable in nature Limited awareness about the source of quality spawn & substrate Dependent on plastic bags which are problematic from an environmental and regulatory perspective Limited access to market information	Limited access processing facilities and technologies Limited working capital Inadequate storage facilities Limited working space	Lack of appropriate post-harvest handling facilities e.g. cold rooms	The most vulnerable population in Kampala who are malnourished cannot afford mushrooms

	Low productivity due to inadequate extension services Low finance available to procure high cost foggers and sprayers			
Mushroom VCA Opportunities				
Input Suppliers	***Producers/Farmers***	***Processors***	***Traders***	***Consumers***
More farmers are taking up mushroom production Undertake more research to improve the use of alternative substrate	Availability of private extension service providers Interest expressed by KCCA to support the mushroom value chains Growing demand for mushroom as a result of the increasing population in the city Mushroom Farmers in Kampala have easy access to market Mushroom growing at small scale can provide both nutrition and a valuable source of income The standard for commercial mushroom spawn production has been developed with the Uganda National Bureau of Standards Mushroom cultivation has the potential to empower youth and women who have not traditionally benefited from commercial agricultural production	Available advertisement / marketing channels including radio, social media and exhibitions	Ready and growing market for mushrooms Mushrooms are price competitive	Benefits of using mushroom products is well-documented and known to health-conscious Kampala residents
Mushroom VCA Threats				

Input Suppliers	***Producers/Farmers***	***Processors***	***Traders***	***Consumers***
Low quality spawn on the market There is no institution that has prioritized investment in spawn production Inadequate information on market size of demanded inputs Dwindling source of cotton husks used as mushroom substrate	Purchase conditions in emerging markets are stringent (e.g. requirements of barcodes, labeling, packaging, terms of payment) High cost of inputs (e.g. substrate spawn etc.) Limited production financing because financial institutions are reluctant to support small-scale agricultural projects Banning the use of plastic bags in Uganda	High cost of processing inputs and facilities Inadequate skills in mushroom processing Lack of skills in postharvest handling technology Unreliable fresh mushroom supplies	The types of products being handled are perishable in nature Weak operation system of the existing cooperatives Unfavorable terms of payment by the supermarkets Poor hygiene/quality of the mushrooms is not in line with the market demand Competition with the mushroom traders from Rwanda, China and South Africa	Poor quality of mushrooms on the market

4.2 SWOT ANALYSIS OF THE LEAFY VEGETABLES VALUE CHAIN

The study revealed that virtually all vegetables produced within the city were either consumed by the producers or sold at farm-gate or to nearby vegetable stalls. There was therefore no processing encountered in the vegetable value chain.

Leafy Vegetables VCA Strengths			
Input Suppliers	***Producers/Farmers***	***Traders***	***Consumers***
Existence of KCCA Agricultural Resource Centre at Kyanja which supplies quality vegetable seedlings	City dwellers mostly with enclosed compounds are growing vegetables in micro gardens Some youth are growing vegetables in available wetlands and open spaces	Existence of a strong network of traders in the city markets Increasing population in the city creates more demand for leafy vegetables	City dwellers are conscious of their diets and are increasingly including vegetables in their diet Existence of new foreign communities which have introduced markets for new vegetable

	KCCA has shown interest in supporting the vegetable value chain in the city Most seeds for local vegetables being planted are saved from the previous crop Availability of improved technology ready for wider adoption		
Leafy Vegetables VCA Weaknesses			
Input Suppliers	***Producers/Farmers***	***Traders***	***Consumers***
Money-hungry traders sell fake seeds and pesticides to unsuspecting farmers Poor seed quality on the market	High cost of technologies for harvesting water for production Lack of irrigation facilities causing inadequate production in farms Limited technical knowledge in production & management of vegetables Over 90% the vegetables traded in the city supplied by farmers from the neighboring districts Small farm plots are an obstacle to raising competitiveness in regards to quality and quantity Lack of capital to invest in commercial vegetable production Farmers do not know how to apply pesticides exposing themselves to the danger Poor access to quality inputs (seeds, fertilizers, pesticides)	The vegetables traded in most of the markets in the city are poorly handled leading to a low quality of vegetable products Wastage of produce due to poor handling and storage Unorganized vegetable reception centers in the markets	Not willing to pay higher prices even in periods of scarcity
Leafy Vegetables VCA Opportunities			
Input Suppliers	***Producers/Farmers***	***Traders***	***Consumers***

The ever increasing new foreign communities that demand or new vegetables, therefore new types of seeds	Availability of new technologies that maximize productivity from micro gardens Majority of producers supplying vegetables in the city mainly produce for the local communities; city producers can take advantage of the niche market for the foreign communities Presence of vegetable traders across the city	Proximity of farmers to the market Farmers are being organized in cooperatives to market their produce Increased demand for leafy vegetables in the market	Existence of more than twenty 5-star hotels in the city who buy vegetables for their clients
Leafy Vegetables VCA Threats			
Input Suppliers	***Producers/Farmers***	***Traders***	***Consumers***
Presence of unregulated agricultural input shops with adulterated pesticides and vegetable seeds	The land in the city is rapidly decreasing due to the increasing population The cost of producing vegetables outside the city is much lower than producing them in the city Unpredictable changing weather patterns Inadequate extension services to the farmers Unavailability of government extension & research officers Occurrence of persistent pests and diseases Presence of stray animals from disrespectful owners	Vegetables are highly perishable Seasonal pricing of vegetables, dictated by the demand	The indiscriminate use of pesticides and fungicides on leafy vegetables poses a health risk to the consumers, as well as environmental pollution Use of contaminated water from swamps and channels to irrigate leafy vegetables especially consumed as salads, also poses a health risk to consumers

5. UPGRADING OPPORTUNITIES FOR ENTERPRISE GROWTH

The boxes below give proposals on short, short to medium, medium and long-term interventions first for mushrooms and then for leafy vegetable value chains.

Factors INTERNAL to the mushroom Value Chain / **Factors EXTERNAL to the mushroom Value Chain**	**Strengths** • Existence of a ready market for mushrooms and vegetables from the middle-class population and the foreign communities in Kampala, who have the capacity to buy them on a routine basis • Increased community awareness about the health and nutrition values of mushroom and vegetable products • Mushroom farming is already an existing practice in the city, utilizing small urban spaces and improved production technologies from research.	**Weakness** • Low and unsustainable production • Weak linkage and cooperation among producers • Inadequate extension service provisions • Poor production and post-harvest handling facilities leading to poor quality products
Opportunities • Interest expressed by KCCA to support both the mushroom value chain • The mushroom enterprise has the potential to empower vulnerable persons to provide both nutrition, and source of income • Mushroom farmers in Kampala have an easy access to market	**Short Term Intervention plan** • Mainstreaming the utilization of technologies focusing at all components of the value chain • Create a platform that brings together the value chain actors • Profiling existing mushroom actors at Division level	**Short – Medium Intervention Plan** • Strengthen the Agribusiness Extension services in the City • Strengthening the existing Division farmer cooperative • Setting up community based bulking centers with post-harvest handling facilities
Threats • Inadequate production and processing skills • Poor quality planting materials • The types of products being handled are perishable in nature • Dwindling source of cotton husks used as mushroom substrate • Reduced land for agriculture activities	**Medium Term Intervention Plan** • Set up a facility to ensure a reliable source of quality mushroom spawn • Create Research-Extension-Farmer linkages to try out alternative sources of substrate for mushrooms • Facilitate farmer innovation to develop technologies suitable for small spaces.	**Long Term Intervention Plan** • Support the development of sustainable and reliable domestic, regional and international mushroom markets; this could be done in partnership with other Development Partners.

Factors INTERNAL to the leafy vegetable Value Chain / **Factors EXTERNAL to the leafy vegetable Value Chain**	**Strengths** • Existence of KCCA Agricultural Resource Centre at Kyanja which supplies quality vegetable seedlings • City dwellers are growing vegetables either in the backyards, open spaces or wetlands • KCCA has shown interest in supporting the vegetable value chain in the city • Availability of improved technology ready for wider adoption • Increasing population in the city creates more demand for leafy vegetables • City dwellers are conscious of their diets and are increasingly including vegetables in their diet	**Weakness** • Over 90% the vegetables traded in the city supplied by farmers from the neighboring districts • Small farm plots are an obstacle to raising competitiveness in regards to quality and quantity • Lack of capital to invest in commercial vegetable production and appropriate technologies. • Limited technical knowledge in production & management of leafy vegetables • Poor access to quality inputs (seeds, fertilisers, pesticides) • Wastage of produce due to Poor handling and storage • Money-hungry traders sell fake seeds and pesticides to unsuspecting farmers
Opportunities • Increased demand for leafy vegetables in the market. • Proximity of farmers to the market • Farmers are being organized in cooperatives to market their produce • Existence of more than twenty 5-atar hotels in the city who buy vegetables for their clients	**Short term Intervention plan** • Organise training and exposure visits for producers to embrace the use of micro-gardening technologies • KCCA Agricultural Resource Center Increase its seedling production capacity to meet the needs of the farmers. • Promote drip irrigation systems and water harvesting tanks to increase vegetable production and productivity	**Short – Medium Intervention Plan** • Develop the leadership skill of the cooperative leaders and members to acquire marketing skills and record keeping for their leafy vegetable enterprises • Support farmers to commercialize their vegetable production by improving access to finance, quality inputs and appropriate technology
Threats • The land in the city is rapidly decreasing due to the increasing populations • Presence of un-regulated agricultural input shops, and the indiscriminate use of pesticides on leafy vegetables poses health risks. • Use of contaminated water from swamps and channels to irrigate leafy vegetables especially consumed as salads, poses a health risk to consumers. • Presence of stray animals • Inadequate extension and research services to urban the farmers	**Medium Term Intervention Plan** • KCCA Agricultural Resource Center to partner with other Resource Organizations, demonstrate the use of biological pesticides and Integrated Pest Management (IPM), with cultural practices and other relevant organic measures to produce vegetable • Popularize the urban Agricultural Ordinances • Popularize and enforce the Local Governments (Kampala City Council) (Markets) Ordinance, 2006, in order to address the issues of order and post-harvest handling in the City markets	**Long Term Intervention Plan** • Collaborate with the Government Analytical Laboratories for access to examine pesticide residue in vegetables. • Undertake a study to identify those leafy vegetables that are on high demand but with scarce supply, and promote them among the urban vegetable farmers

The short term interventions are proposed to put into use the identified strengths so as to fully utilize opportunities available to the mushroom and vegetable enterprises.

The short to medium term interventions are designed to remove the identified weaknesses to fully utilize opportunities available to the mushroom and vegetable enterprises

Medium terms interventions are proposed to put in use the identified strength so as to reduce the effect of the threats to the mushroom and vegetable enterprises

Long terms interventions are proposed to remove the identified weakness so as to remove the threats facing the mushroom and vegetable enterprises

6. CONCLUSIONS AND RECOMMENDATION

This study clearly illustrates that mushrooms are an economically viable enterprise that can be undertaken in urban and peri-urban areas and hence can create reasonable incomes for those engaged in its production and sales. This can be taken as a critical intervention to combatting the increasing unemployment rates being experienced in Uganda at present[9]. As the mushroom industry grows, there is need to ensure that the required inputs are steadily supplied to producers. The National Agricultural Research Laboratories (NARL) can be brought on board to offer a solution towards the adequate production of good quality spawn.

There are reasonable margins for actors engaged in the mushroom and vegetable trade. Nonetheless, most of the actors in these chains may not be conversant with such analytics since their record keeping culture is poor. As such, some of the actors, mostly producers/farmers, often fall prey to exploitation of being offered very low prices. As such, farmers need to be trained on farming as a business with emphasis placed on record keeping. Furthermore, options of processing what is not immediately sold into secondary products that have longer shelf-life should be exploited with help of research organizations and food processing incubators. KCCA should bring onboard institutions like NARL and Makerere University School of Food Technology, Nutrition and Bio-engineering (MUSFTNB) and the Uganda Industrial Research Institute (UIRI) to offer user friendly solutions relating to adding value to mushrooms and leafy vegetables. KCCA should advertise its Agriculture Resource Center as well as increase its seedling production capacity.

Since the urban vegetable farmers produced very low quantities of vegetables, whose market prices fluctuated with seasons, there is need to undertake a study to identify those leafy vegetables that are on high demand but with scarce supply and promote them among the urban vegetable farmers for a niche market.

External markets should only be explored when the internal market demand and product standards have been satisfied. This is especially related to product volumes, standards and the types of mushrooms. External markets would prefer other mushrooms varieties than oyster mushrooms and the internal markets does also demand a higher volume and other varieties than oyster (e.g. Button and Portobello). This therefore calls for an independent study of the potential of mushrooms production to external markets. This study should include exploring which types of mushrooms external markets demands and in which standards they demand it. It is important to notice that exploring external markets should be seen as a long-term plan and that, the short and medium term should be explored first a mentioned in chapter 5: “Upgrading opportunities or enterprise growth”.

For the above-mentioned interventions to be done, actors in the two value chains can form platforms through which they can be profiled then assisted with information, extension services and micro-credit as well as other business support services. Through such platforms, they can also be able to engage with KCCA and other relevant agencies to support their respective industries. Again, through such platforms, SACCOs and producer cooperatives can be formed or strengthened, where they exist, as a means of better integration of actors in the marketing arena.

Overall, despite diminishing levels of green space, there is adequate space left to pursue agriculture in the city. This is mostly applicable to vegetables. An important outcome of the study is that for growing mushrooms and for micro-farming of vegetables, no green space is required. The study therefore did not find a strong correlation between green space available and farming activities.

[9] https://tradingeconomics.com/uganda/unemployment-rate

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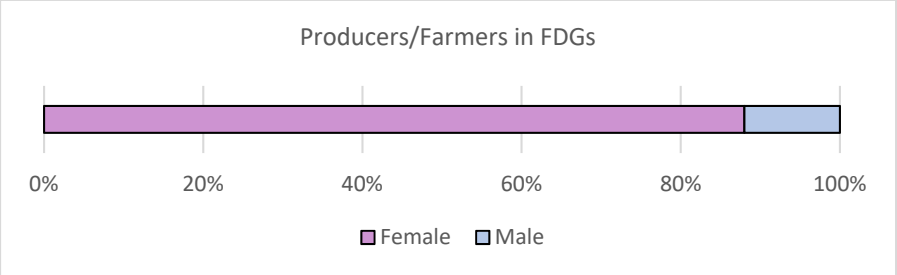
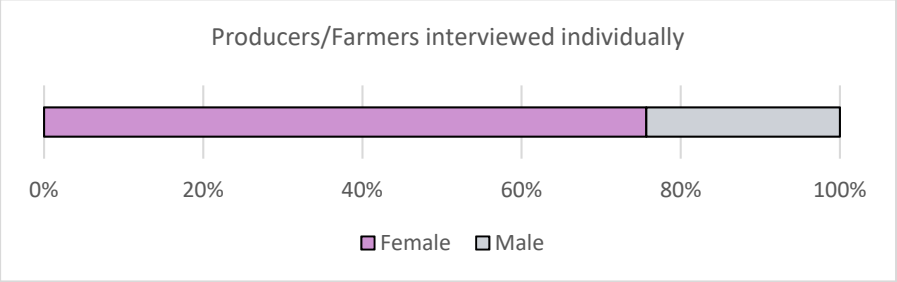
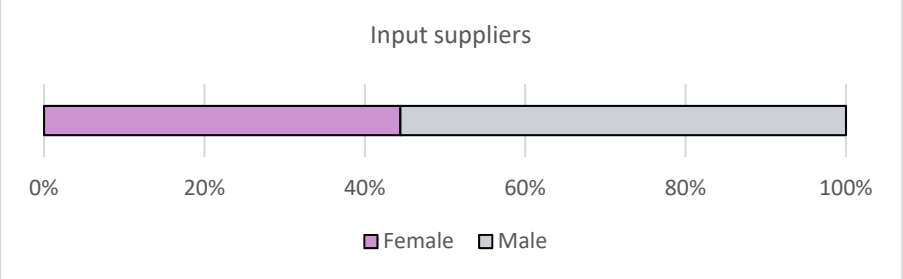
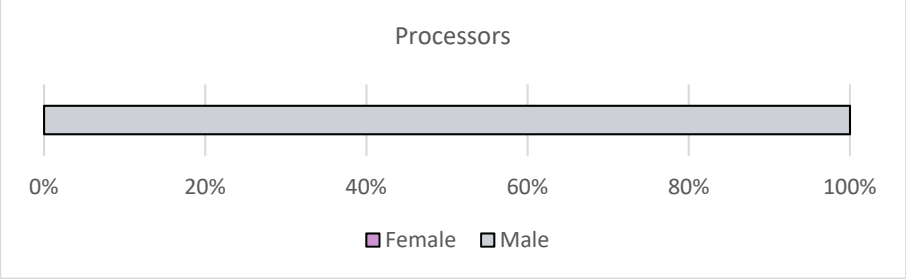
APPENDIXES

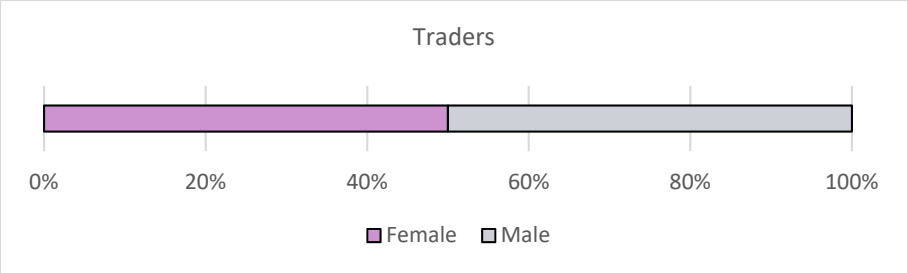
APPENDIX 1 GRAPHICAL REPRESENTATIONS OF GENDER BREAKDOWN ENCOUNTERED IN THE SURVEY

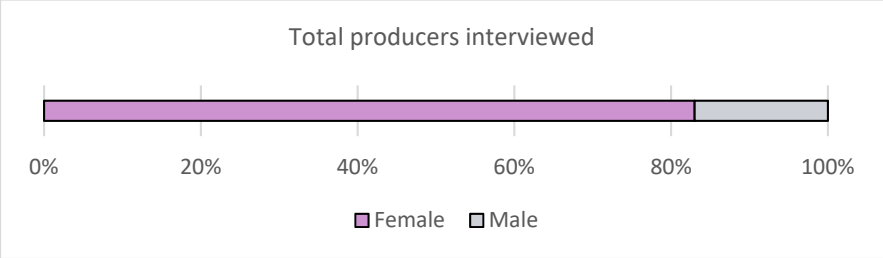









Traders
0%
20%
40%
60%
80%
100%
Female
Male


Total producers interviewed
0%
20%
40%
60%
80%
100%
Female
Male